

SCIENTIFIC AMERICAN

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[NEW SERIES.]

NEW YORK, JUNE 15, 1878.

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THE HIGH-LEVEL STREET RAILWAYS OF NEW YORK.

When the elevated railways, now in progress of construction in this city, are completed, four great iron bridges, with numerous branches, will run lengthwise Manhattan Island. Perhaps in the future, after people become habituated to trains thundering over them, to thoroughfares blocked with great iron columns, to the impartial distribution of ashes, oil, and sparks upon the heads of pedestrians and on awnings (a couple of the latter were set on fire this way the other day), to the diffusion of dirt into upper windows, to the increased danger of life from runaway horses and the breaking of vehicles against the iron columns, to the darkening of lower stories and shading of the streets so that the same are kept damp long after wet weather has ceased, and to the numerous other accidents and annoyances inherent to this mode of transit, more such bridges will be erected, and we shall have two storied streets. Doubtless shops will be made in second stories on the lofty railway lines, with bridge connections, after the manner which a large fancy-goods dealer on Sixth avenue is already taking measures to put in practice. The business population on some thoroughfares will be troglodytes—dwellers in dark and shaded caverns—and the other portion will be aerial. There will thus be a differentiation, so to

ter street to Harlem, where it traverses the island over to Eighth avenue. On the west side the last mentioned line extends along Eighth, has its longest stretches on Ninth and Sixth avenues, and finally reaches Bowling Green by way of

sweep of the structure as it traverses the Battery Park, and Fig. 5 represents the station as seen through the ferry gates at South ferry. In Fig. 4 is given a section showing the construction of this road along Third avenue, and by compar-

ing this with Fig. 2, on this page, the reader will perceive the essential differences between the two plans. Fig. 2 represents the portion of the Gilbert road on West Broadway near Canal street, where, as is the case along most of its route, it spans the street car tracks. The Third avenue structure is much the more graceful, the tracks being directly supported on light lattice work pillars, and not on girders between the supports, as on the Gilbert road. The pillars are braced and connected by a simple arch. This plan, although it is fully as obstructive to the street as the other, is the least objectionable, as it does not materially shade the roadway below. The station at 23d street and Sixth avenue, on the Gilbert Road, is represented in Fig. 1. The buildings are now in process of erection, and will be quite tasteful in design, but the

extensive area covered by them results in their materially cutting off the light and air from the thoroughfare beneath. Work is now being rapidly prosecuted both by day and night on the Gilbert line, and it is expected that regular traffic will be begun in a few days.

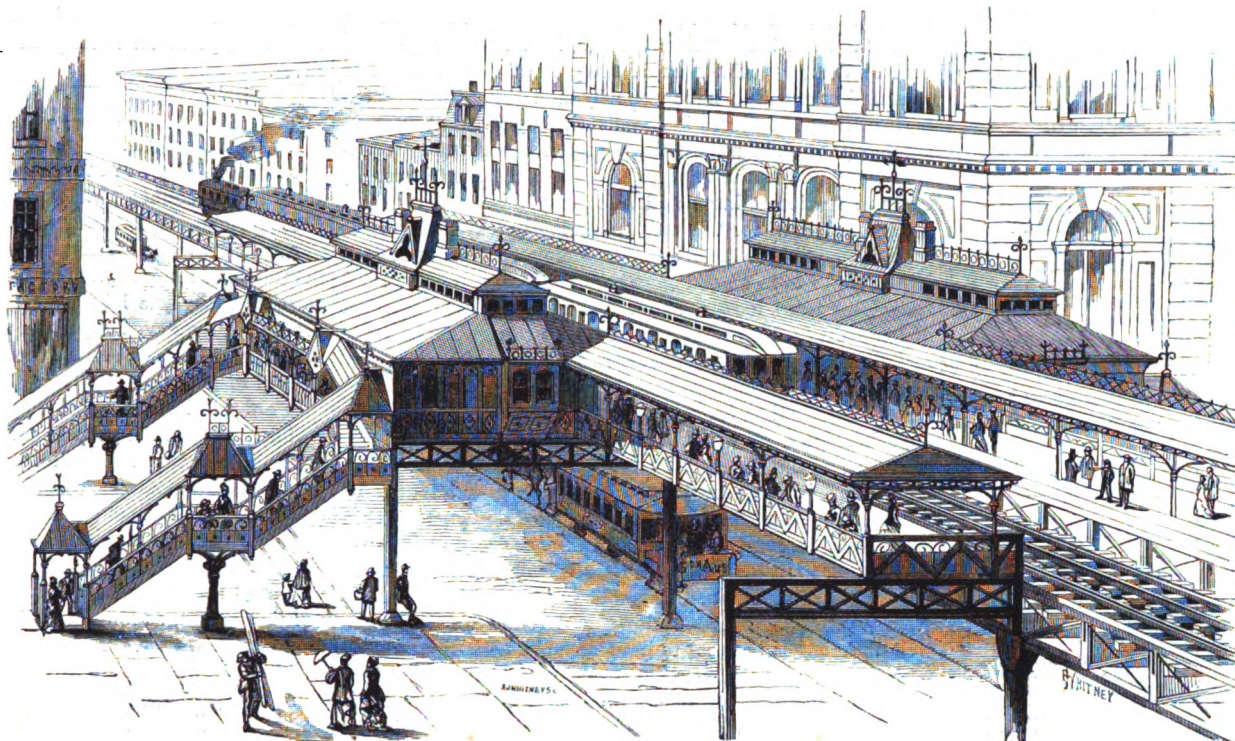


Fig. 1.—ELEVATED RAILROAD STATION, 23D STREET, NEW YORK

South Fifth avenue, West Broadway, and some of the smaller streets. The New York Elevated Road, on the west side, extends chiefly along Ninth avenue and has its lower terminus at the Battery. Two views of this last mentioned portion of the line are given on page 370. Fig. 8 shows the

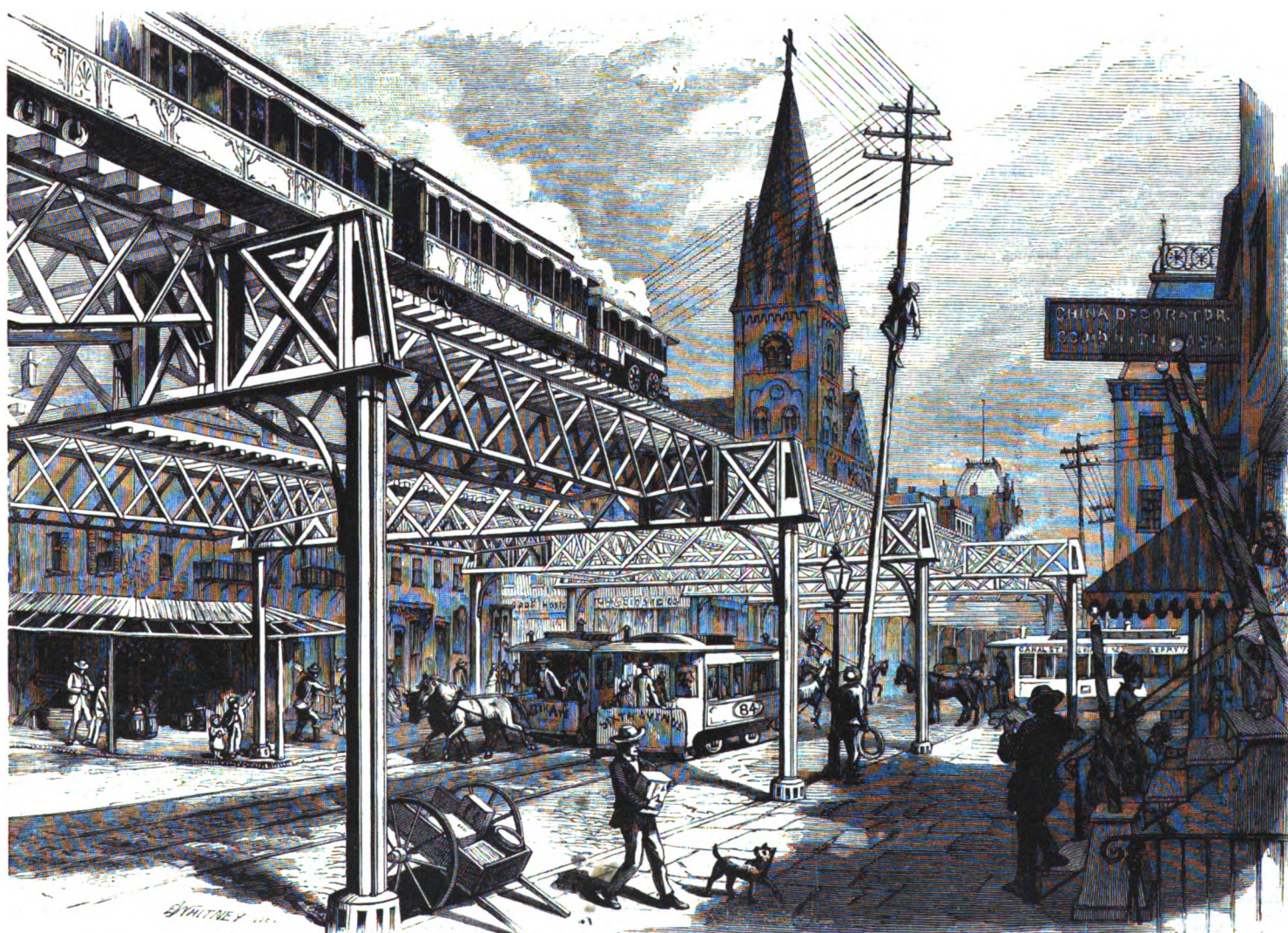


Fig. 2.—ELEVATED RAILROAD, WEST BROADWAY AND CANAL STREET.

Eels Attack- ing Shad.

The Hartford (Conn.) Times says: "Eels often attack the shad in the nets, after the shad have been caught in the river. They enter the shad at the gill openings, and suck out the spawn and entrails, leaving the fish perfectly clean. Fishermen say that the shad thus attacked are the best, for the eels will not enter any but the fattest fish. Eels also follow the shad all the way up the river, and devour the spawn. Were it not for these natural destroyers the shad would increase to an amazing extent."

When the four bridges are finished they will aggregate in length about between sixty and seventy miles, and there will be two on each side of the city. On the east side the New York Elevated Road runs a double track from Whitehall through Front and Pearl streets, Bowery, and Third avenue to the end of the island, at Harlem. The Gilbert Road has a circuitous route from Bowling Green to Second avenue, and along the lat-

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NEW YORK, SATURDAY, JUNE 15, 1878.

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- VI. MEDICINE AND HYGIENE.—The Infectious Nature of Yellow Fever. By JAMES J. L. DONNET, M.D. Yellow fever vs. remittent fever.—Successful Treatment of Hydrophobia.—Alcohol Dressing in Scalp Wounds.—Color Blindness.
- VII. AGRICULTURE, HORTICULTURE, ETC.—Canadian Phosphate.—Mineral Phosphates.—The Hop as a Vegetable.—Hot Water as a Restorative for Plants.—Marechal Niel Rose.—Kumination.
- VIII. MISCELLANEOUS.—Professor Max Muller, with portrait. The Paris Art Exhibition. The exhibits of Tunis, Persia, Norway, Sweden, Great Britain, Canada, Germany, the United States, Italy, Holland, Portugal, Denmark, and South America. 1 illus.
- IX. CHESS RECORD.—Biographical Sketch of F. E. Brenzinger, of New York, with Portrait and one of his Problems.—Letter Problem.—The Huddersfield College Tourney No. 1.—Chess in Literature.—Solutions to Problems.

SILVER MINING IN MASSACHUSETTS.

Early in 1873, considerable public interest was awakened and some speculative excitement aroused by the announcement in local journals of the discovery of mines in the vicinity of Newburyport, Massachusetts, which were yielding even at the surface ores rich in silver, and in some cases containing appreciable amounts of gold. The reports were, as is usually the case under like circumstances, greatly exaggerated, and those who expected to find gold in nuggets and silver in the native state were considerably disappointed to encounter both metals only in the form of sulphurets, the one occasionally in auriferous pyrites, the other in argentiferous galena and in gray copper (tetrahedrite). The first assay of the new found galena showed that one ton of the ore represented a value of \$179, lead and silver together, the latter existing in the proportion of 68 ounces to the ton, and as other trials resulted in even more promising data measures were at once set afoot to develop the mineral resources thus brought to light. With the speculative mania which ensued, whereby land hitherto deemed little more than a rocky desert suddenly became exceedingly valuable, and with the vicissitudes of the numerous concerns which were started to mine the precious metals, it is not our purpose here to deal; especially as at the present time the era of speculation seems to have gone by, and several mining experts of long experience in the silver mines of the West have entered (though in a limited way) upon the systematic development of certain veins, which offer, we are informed, every indication of large and valuable yields.

The region where the ores abundantly exist (for it is scarcely possible to break an outcropping rock without finding traces or even a good showing of galena) is a barren and forbidding tract, located about two miles to the southwest of the town of Newburyport. Over how large an area the metalliferous deposit extends no two estimates seem to agree. The geological formation, or rather lack of formation, almost defies classification, for it is evident that great natural forces have here been at work both to roughen the face of the country and inextricably to intermingle the strata. The metal bearing veins are known to ramify over an area of five by two miles, for a shaft sunk almost anywhere within these limits is reasonably certain to strike ore, and it is reported that in reality the metalliferous beds underlie a much more extended region. There is hardly a farmer in the vicinity who has not dug down and found ore, and mere well digging has brought to light some remarkably fine deposits. These little shafts, however, can hardly be counted, but beside nearly every one, and most of them appear to be abandoned, there is a heap of ore from which rich specimens of galena can easily be picked out. Occasionally this shallow excavation demonstrates the existence of a large vein, as in the case of the so-called "Big Quartz Vein," which, though prospected only to the depth of 30 feet, is found to be 18 feet wide on the surface, with outcroppings at a distance of some 2,500 feet. It lies between a wall of feldspathic trap or greenstone on one side, and a talcose slate on the other, and surface assays yield gold and silver in about equal value to over \$20 per ton.

It may be said of all the mining operations thus far conducted in the vicinity that they are little more than surface prospecting, a fact clearly apparent from the details of some of the principal mines given further on; and we are assured by experts, who have made special examinations, that deeper mining offers every prospect of substantial success. The difficulty, however, is lack of capital to put up the necessary works for treating the ores on the spot. Owners and parties interested in different mines all agree in stating to us that a mill, capable of handling the 200 tons (rough estimate) per day taken from the principal shafts, would probably prove remunerative to whoever would establish it; but where there were so many small disinterested interests it was useless to expect the same result through co-operation. The fact seems to be that the mines that are still worked require all the available resources of the owners to keep them free from water, and the ore that is taken out simply lies in heaps in the sheds.

The mine known as the Merrimac is the largest, and besides has the most extensive plant. It is under the superintendence of Mr. Edgar Shaw, who informs us that one pocket of gray copper that was encountered in it yielded 8 tons of ore, which was sold at \$2,150 per ton in Liverpool. The pay streak of galena now being worked is 2 feet wide, and thus far 312 feet long, yielding about \$70 per ton. The shaft has a depth of 200 feet. This mine has been open about five years, and has paid 12 dividends, showing a net profit of about \$80,000. Owing to a defalcation and loss of funds its operations are at a standstill, although a new milling plant for concentrating the ore by the Hooper process has just been erected.

The China mine was opened in last September, and has a shaft 90 feet deep. The vein being worked is about 4 feet in width. About 300 tons of ore have been taken out, averaging in value \$200 per ton. Gray copper assaying as high as \$1,000 per ton, a few specimens of ruby silver, and considerable zinc are also reported to have been found. Of the other mines, the richest bonanza is believed to exist on the so-called Noyes property, where gold is the proportion of over 20 dollars' worth per ton is found in auriferous pyrites, besides a rich showing of silver in the gray copper and galena. In the Newhall mine, gold has been found in patches in the gray copper, and the ore has assayed at \$26 per ton.

The other mines are sinking shallow shafts, and are

worked in a spasmodic manner, as the owners have funds to devote to them.

So far as our superficial inspection of the mining region, and as the statements of those familiar with the operations extended, there seems to be no reasonable doubt as to the existence of the large metal bearing deposits alleged to exist. Nor in view of the general prevalence of rich looking ore already on the surface, and the results of apparently well authenticated assays, does it seem improbable that the value of the deposits is in any degree less than the experts on the spot allege. As to whether the refractory ores can practically be manipulated on the spot, so as to pay, and whether the products of the mines will hold out in uniform richness, these, besides many others, are questions for the mining engineer to answer after proper examination of the present status of the field. It is but right to say that the value of the mines has been disputed, and there seems to be a lack of exact information relative to them which suggests the idea that it might be to the interest of mining experts, as well as of public importance, to have more extended surveys and investigations made at an early day. Assays of specimens of galena, collected at random from numerous ore heaps at the mines, yield an average of \$27.96 per ton in gold and silver.

COUNTERFEIT COIN.

It would hardly be supposed that so large an amount as two million dollars in counterfeit silver and gold coin is now afloat in this country, but such, according to the estimate of Treasury experts, is the fact, and, moreover, the total is constantly increasing. This spurious money passes through thousands of innocent hands, until finally it is caught in the meshes of the nets laid by the Secret Service or is recognized by a lynx eyed expert in some large bank. Then the unfortunate holder becomes the victim of the counterfeiters' skillful rascality.

In order to imitate a coin successfully—that is, so that it will deceive, not the general public, because probably most persons never take a second look at the coin they receive, provided its appearance seems right, but the clerk or cashier moderately well accustomed to handling money—the counterfeit must regard both execution, size, and weight. The last is most important in gold coin, because the least current weight of the latter is established, whereas in silver a coin of light weight, so long as the reduction is not manifestly too great, will pass. The standard weights and least current weights of gold coin are as follows:

20 dollar piece—Standard,	516 grains;	least current weight,	513-68
10 " " " "	258 " "	" "	256-71
5 " " " "	129 " "	" "	128-96
2½ " " " "	64 5 " "	" "	64-18

Any decrease in weight below the latter figures subjects the holder to a loss equivalent to the difference. This decrease may occur by wear, or, as is very often the case, through sundry nefarious processes, which, though not properly counterfeiting, nevertheless belong to that species of crime.

These operations are perhaps the most dangerous to the community, because as a rule the coin preserves its appearance, is apparently genuine under the acid test, and in fact is genuine except in weight. It is impossible, for example, to tell whether a coin has been "sweated" or not without weighing it, and by sweating is meant the use of the coin as the anode in the electroplating bath, the gold being abstracted from it and deposited on another surface. Of course a uniform quantity is removed from the entire surface, and the imprint retains its original sharpness. As much as two dollars' worth of gold is sometimes taken from the double eagle in this way. A less scientific plan is one too commonly adopted by conscienceless jewelers, who when they want a little gold, instead of buying the precious metal, purchase a twenty dollar piece, file off with a dead smooth file a sufficient quantity, reburnish the place, and pass off the coin at full value. The most extensive fraud perpetrated on gold coinage is "splitting." The operator uses a fine saw to split the coin neatly in two. Then he gouges the gold out of the center until only a thin outside shell is left, and substitutes a silver and platinum alloy for the metal thus abstracted. The two parts are then joined with gold solder, and the edge is remilled. In this way, we are informed, gold to the value of \$15.50 has been taken from a single piece. The operation, however, generally destroys the ring or tone of the coin, leaving it, besides, either too light or too thick. Another swindle is to bore into the edge, and it is said that John Chinaman favors this game, buying up the pieces, sending them to China, so that his dexterous compatriots may there manipulate them in safety, and subsequently reimporting them to set them adrift upon the unsuspecting American public. The holes whence the gold is taken are refilled with silver, covered with gold solder, and the edges are neatly finished; but the light weight reveals the theft. From 5 to 7½ dollars' worth of gold has thus been taken from one coin, and the pieces of course have every appearance of being genuine. Real counterfeits—that is, coin wholly spurious because made of base metal—are almost invariably below weight. An exception to this, however, exists in a \$5 piece which is of the exact standard weight of 129 grains. It is composed of an alloy of gold and silver, and is worth from \$3.70 to \$3.40. Its appearance and tone are excellent, but it is thicker than the genuine coin, and hence may be detected by the gauge. Still it is one of the most dangerous counterfeits in existence.

As we have stated a silver piece passes current so long as the imprint is not badly defaced or weight greatly reduced. A hole through the coin, however, condemns it—a fact, we

believe, not generally known. The low value of silver prevents any such proceedings as in the case of gold, as the amount which could safely be abstracted will not pay for the trouble of doing it. Consequently all silver counterfeits are true imitations, and there is hardly a date of dollar, half dollar, or quarter which has not been copied with remarkable accuracy. The counterfeiter either makes a mould in plaster from the real coin and casts from it, or he stamps his imitation in dies. As this last process is the same as is in use in the mints, the counterfeits thus produced are more difficult to detect, because, besides being more accurately finished, the compression which the alloy receives brings it nearer to standard weight. A large number of counterfeit silver coins are made chiefly of type metal. A very dangerous half dollar is composed of silver, copper, and zinc, and is worth about 17 cents. It is from 7 to 10 grains too light. Spurious half dollars have appeared which constantly deceive bank tellers and other experts because they are of full weight. They are made of a compound similar to German silver, and are so well plated with genuine silver that the acid does not affect them. They are, however, too thick, and the gauge, as usual where the balance fails, shows the fact. Counterfeits of the quarter dollar, though very plenty, are less dangerous than those of larger pieces. They are composed of antimony, tin, and lead, and are both too light and too thick, although they have a good ring. A peculiar composition has been employed, to which powdered glass is added to give a clear sound; but this is but a clumsy expedient, as the coin is far below proper weight, a fact easily appreciable by mere handling.

It is a difficult matter to lay down any general rules for detecting counterfeit coins, as it will be seen from the foregoing that the closest ocular inspection may be wholly at fault. One of the most ingenious little mechanical contrivances for both measuring and weighing coin, and which has, we are informed, been adopted in the United States mints and Treasury and many banks, will be found illustrated in our last issue. In general the milling on the edge of the counterfeit coin is always poorly executed as compared with the genuine; but wear of the latter often renders the distinction difficult to draw.

Another point worth remembering is that absence of clear tone in a coin is not necessarily proof of its falsity, because it may and does happen that a crack or flaw is made in the metal during the rolling, and this, just as in a bell, will of course destroy the vibrations and make the sound dull and flat.

ARTIFICIAL FUEL.

It is well known that owing to the brittleness of anthracite there is a large waste in mining it. The comminuted material being too fine to be merchantable has accumulated in immense heaps near the mines, cumbering the ground and at the same time standing as tangible evidence of the necessity of some means for its utilization. Processes for this purpose have not been wanting, and when they failed as many have it was frequently because the fuel in the heat of the furnace lost its form and choked up the grates, but more commonly because the cost of manufacture was such that competition could not be made with the lump coal. Inventors of artificial fuels based on anthracite culms too often overlook the fact that the success of their process necessarily includes an increase in value of the culm in proportion as the demand for it is augmented. Says Mr. Frederick Prime, in his report as a judge at the Centennial Exposition on "coals:" "As quickly as this value touches a certain point it then becomes impossible for the artificial fuels to compete with the lump anthracite. Nor can they do this even when the culm is obtained for a mere song when the price of anthracite is very low. Consequently it is very probable that the manufacture of artificial fuels will for many years be limited, both as to quality and the purposes for which they are used."

The principal processes introduced of late years are the Loiseau, the Newton, and the Endres. The first is the invention of Mr. E. F. Loiseau, and has achieved remarkable success both in this country and abroad. It is claimed to be the first ever used to make artificial fuel for domestic employment by mechanical processes on a commercial scale. We illustrated Mr. Loiseau's ingenious train of machinery some four years ago, and its operation can be briefly summed up. The anthracite dust, after being dumped on a covered platform, is received on a screen, which after screening the coal delivers it to an elevator which raises and discharges it into a bin. Meantime dry potter's clay is suitably ground, and in a separate tank a liquid mixture is made of lime, rye flour, and water; 95 per cent of coal dust and 5 per cent of clay are mechanically taken from the bins, delivered under a chain elevator, and there sprinkled through a perforated pipe with the liquid composition. The compound is conducted between rollers, in which are cavities which mould it in egg shaped form, thence passes to a drying oven, through which it passes five times, to and fro on a belt, thence the lumps are carried through a waterproofing composition, and finally they pass through a drying oven, emerging perfectly dried and ready for the market. This fuel burns well, retains its form, and leaves as a residuum the clay and any other solid impurities besides the ash.

Newton's fuel has not yet been produced on a manufacturing scale. It is composed of coal dust and coal tar, placed in a retort, which distills out the volatile products, the residue of the coal tar, some 2.5 per cent, remaining

behind as a binding medium. Mr. Prime in the report before us says that the product seemed too friable to stand much handling without particles of the coal wearing off from the lumps, but it burns freely, without smoke or sulphurous fumes, and if left untouched retains its form until consumed. It is more friable than the Loiseau fuel, but leaves less ash.

The Endres process is worked by the Anthracite Fuel company of Rondout, in this State. It uses 100 parts anthracite culm to 10 parts "fuel pitch" or bitumen of coal tar. This pitch is previously prepared by passage through crushing rollers, and it is mechanically combined with the coal in exact proportions. The mixture is then heated, the pitch melting, and it is afterward moulded under heavy pressure into bricks weighing about 15 pounds each. This fuel Mr. Prime states to be a steaming coal of uniformly high average. During 1876 it was supplied to six railroads in New York and Connecticut, eliciting favorable reports from all. On the Hudson River Railroad the economy in its favor was estimated at about 15 per cent.

SILVER IN ART.

In a short but interesting article on this subject in the *International Review*, Mr. Edwin C. Taylor has described a few of the more novel methods of ornamentation of silver that have not yet become generally familiar. And, by the way, the author expresses it as his opinion that in view of the fact that the yield of this metal in our own country is destined, for years to come, to be greatly in excess of the natural demand, it would be far better to divert it to the uses of art than to make it the means of striking a blow at our national credit. In view of the late action of Congress, however, it would seem that our legislators are not disposed to regard metallurgy from an æsthetic standpoint.

Conspicuous among the newer methods of ornamentation of silver is that of inlaying with niello, somewhat after the manner of the *Champlevé* enamel, and similar to the much admired Russian work at our Centennial Exhibition. The art of applying this enamel was for a long time regarded as a Russian secret, although the metallic oxides, of which it is composed, were well known to our metallurgists, and it has lately been successfully employed by craftsmen of Paris and London. This valuable ornamental agent was developed in America only last year, and its use in connection with silver offers the greatest advantages, from the fact that it can be worked with equal facility in mass or in the most delicate lines. Niello, unlike the vitrified enamels used in *Orisonné* ware, will bend with the body in which it is inserted, and is therefore not liable to destruction through fracture or abrasion. In connection with this very flexible composition, pure metals, such as copper, iron, and gold, are also inlaid by an ingenious process, so that it is possible to obtain a durable surface possessing the beautiful polychromatic effects that were but lately produced only by superficial methods of decoration, such as electro-plating and oxidation.

Another method of silver ornamentation, which has proved to be susceptible of rare delicacy of treatment, is that styled *Appliqué* work.

In this process each ornament is first separately wrought in the same manner as a piece of jewelry, laid upon the surface to be embellished, and held in place by ligatures of fine wire, while a careful blast from a blow-pipe directed upon it secures perfect fusion between it and the original body. In this way Japanese figures of birds, fishes, foliage, and Persian ornamentations of floral and other decorations may be admirably treated. By this process of applying raised ornament, too, another feature of decoration is introduced, which, until the current year, has never been known outside of the curious workshops of the jealous Japanese, into whose precincts the foot of the "barbarian" is never allowed to enter, nor his eye to peer.

The material used in this process may be called "Japanese alloy," and it is applied in the manner described in regard to raised ornaments of silver. This alloy is composed of certain metallic substances that are capable of receiving and retaining various shades of color, such as blue-black, gray, yellow, brown, violet, and vermillion, used separately or together, or mixed with gold. "The opportunities for metallic decoration which this wonderful and highly valuable compound affords are vast indeed, and render it easy to present the gorgeous plumage of birds, and all the beautiful hues which the wealth of nature yields, in the durable form of metal objects." The discovery of this secret in metallurgy is the result of a long series of patient experiments, and its development will be watched with great interest by those who are accustomed to follow the progress of American industrial art. It is said that the use of this alloy, yet in its infancy here, "is likely to result in the production of rarer and costlier art objects of silver than modern art has known, and the chryselephantine treasures of archaic times will doubtless be rivaled by the many-colored products of American workshops."

In conjunction with the various kinds of ornamentation, a very peculiar and quaint effect is sometimes produced by leaving the entire surface of the object impressed with the dints of the hammer. This finish imparts an appearance not unlike that seen in the Chinese "crackle" pottery. Sometimes the objects are indented with an edged hammer horizontally, so that the lines appear like waves of water. And in connection with this, a very novel and pleasing effect is produced by the introduction of raised figures of fishes and marine plants.

In noting these novelties in connection with the develop-

ment of metallurgy in our country, it is gratifying to feel that we possess artisans of such skill that no foreign secret processes are beyond their power of grasping, and that our people have the taste and the will to encourage their efforts.

FORMATION OF PLANETARY RINGS AND SATELLITES.

According to the great nebular hypothesis of Laplace, the planets owe their formation to the abandonment of zones of vapors which the primitive solar nebula left at the limits of its atmosphere, when, through the effect of cooling and contraction, the velocity of rotation of the mass progressively increased. These rings of vaporous matter ultimately condensed into separate nuclei, constituting the planets, which consequently at the beginning had the same constitution as the solar nebula. "In this state," says Laplace "the planets perfectly resembled the sun in nebulous condition," and they became rings and satellites circulating around their primary in the same direction as the movement of rotation of the latter, and turning on their own axis also in similar direction. All bodies which circulate around a planet having under this hypothesis been similarly formed by zones which its atmosphere has successively abandoned, and its movement of rotation having become more and more rapid, the duration of this movement should be less than that of the revolution of these different bodies, as in the case of the sun as compared with the planets. All this is confirmed by observation."

This at the time when Laplace wrote was true. The movement of the moon, for example, is 28 times less considerable than that of the earth's rotation; the first satellite of Jupiter, nearest to the planet, revolves in $1\frac{1}{4}$ days, and its movement is four times less rapid than the rotation of Jupiter, which occurs in 9 hours and 55 minutes. Mimas, the satellite of Saturn, having the shortest period of revolution, about 23 hours, moves in more than double the time required for the rotation of the primary, and even the nearest brilliant Saturnian ring turns about $\frac{1}{6}$ of a day less rapidly than the planet itself. All this accords with Laplace's law.

The newly discovered satellites of Mars render the system of that planet analogous to that of Jupiter, Saturn, or Uranus. But the first satellite of Mars, the distance of which from the center is 2.7, or less than three times the radius of the planet, makes its sidereal revolution in a period of about $7\frac{1}{2}$ hours only, three times less rapidly than the rotation of the primary is accomplished.

M. Edouard Roche has recently published an essay wherein he advances a new theory to account for this remarkable anomaly. He considers that during the contraction of a nebula there is not merely, as Laplace suggests, an abandonment of exterior rings, condensing at the equatorial limit where the central attraction equilibrates the centrifugal force. The portion of the nebula, he says, which becomes free at each new stage of cooling comes from a fluid layer which extends to the poles, and which is diverted on both sides, to meet finally outside by the equatorial line as by a sort of opening. It results that in flowing to the equator, one part of this nebulous matter arrives there with too low a velocity to allow of its circulating internally. The result of this is, that instead of separating from the nebula to form exterior rings and later satellites analogous to those known, this matter, re-entering the atmosphere of the nebula, forms there interior rings, which, at first describing more or less elongated ellipses, end by being transformed into circular rings. One part of Saturn's rings appears to be due to this mode of formation, and the same theory is advanced as accounting for the anomaly observed in the first satellite of Mars.

The Lighthouse Board.

The decease of the distinguished Professor Henry left a vacancy in the United States Lighthouse Board, which has lately been filled by the appointment of Professor Henry Morton. This gentleman is well known in the scientific world for his experimental researches and discoveries in connection with light and the appliances for its production. His appointment will give very great satisfaction.

As President of the Stevens Institute of Technology, Hoboken, N. J., he has conducted the affairs of that institution with judicious skill, and has evinced the possession of executive abilities of a high order. He was, in fact, the organizer of the institution, which under his auspices has come to be widely celebrated for excellence.

The lighthouse system of the United States is under the control of a board of seven persons, consisting of two naval officers, two army officers, two civilian scientists, and a naval secretary. The Secretary of the Treasury is the President of the Board and controls all its decisions. But we cannot doubt that the influence of Professor Morton will prove useful to the Board, by helping to renew its vigor, and perhaps by assisting to increase the luminosity of some of our lighthouses.

American Society of Engineers.

The tenth annual convention of the American Society of Civil Engineers will be held at Boston, beginning Tuesday, June 18, 1878. The list of topics to be considered is a long and interesting one, and the programme includes a number of excursions to points of professional interest in and about Boston. The meetings of the convention will be held in the hall of the Massachusetts Institute of Technology.

A Long Way to Pasture.

Mr. John M. Wilson, United States Consul at Hamburg, reports that the exportation of live stock from this country to Schleswig-Holstein, to be fattened on the rich pastures of that country, bids fair to become a very lucrative business. At the suggestion of Deputy-Consul Moeller, a native of Schleswig-Holstein, the grazers of that province sent a steamer to this city for a cargo of lean cattle, which were purchased at Chicago, and a few fattened animals for the English market. The latter numbered

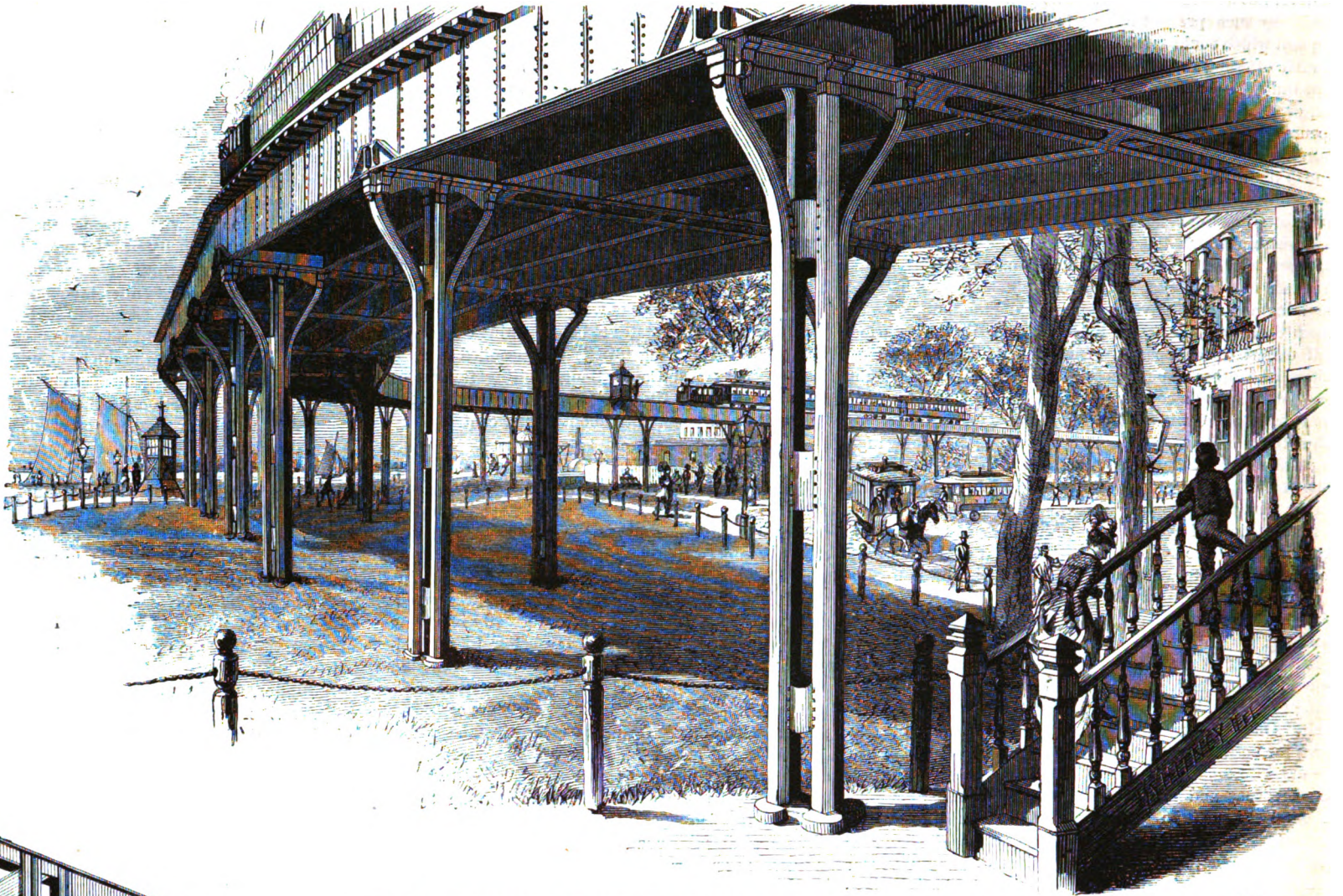


Fig. 3.—NEW YORK ELEVATED RAILROAD AT THE BATTERY.

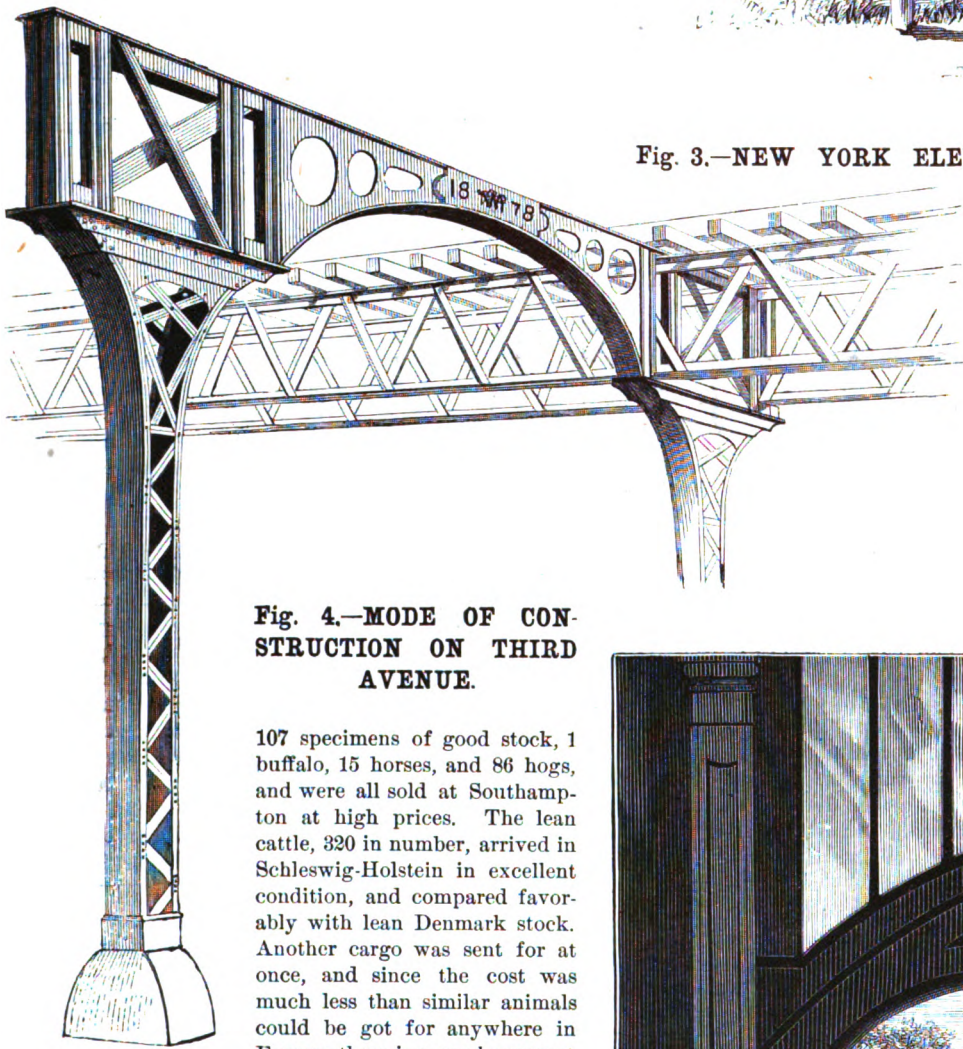


Fig. 4.—MODE OF CONSTRUCTION ON THIRD AVENUE.

107 specimens of good stock, 1 buffalo, 15 horses, and 86 hogs, and were all sold at Southampton at high prices. The lean cattle, 320 in number, arrived in Schleswig-Holstein in excellent condition, and compared favorably with lean Denmark stock. Another cargo was sent for at once, and since the cost was much less than similar animals could be got for anywhere in Europe, there is a good prospect

that the United States will be looked to hereafter for the entire supply for these rich pasture grounds, where thousands of cattle are fattened every year for the markets of France, Germany, and England.

Asphaltic Wood Pavement.

Recently at the Society of Engineers, London (Mr. R. P. Spice, President, in the chair), a paper was read by Mr. Henry S. Copland on "Modern Roadway Construction." The author first adverted to the extent to which the work of road making was constantly going on at the present time, and noticed the progress made by the various nations of antiquity, the state of decay into which the medieval roads had been allowed to fall, and the various attempts made to improve them since the beginning of the present century. He then described the principal systems of roadway construction now in use, and pointed out the extent to which, he considered, they met, or failed to meet, the requirements of a good modern roadway; namely, safety, easy traction, noiselessness, freedom from dust and mud, durability, facility, and cheapness of construction, maintenance, and repairs to itself, and to the gas and water mains, etc. He explained the principles upon which, with a view to avoiding the defects of previous systems, he had designed the asphaltic wood pavement, the use of which was now increasing. This pavement consists of a bed of concrete, with a layer of asphalt over it. Upon this are laid transverse

courses of red pine blocks, with intermediate spaces. The spaces are filled in partly with heated mastic asphalt, and then with coarse lime and gravel grout, flushed with hot air, to the surface of the roadway. About an inch of coarse gravel is then spread over the roadway and left to be worked in by the traffic. The author finally examined into the expense of construction and maintenance of the various systems of roadway, drawing the conclusion that though, for town roads, macadam was the cheapest in original cost, it was by far the most expensive over a term of years, whereas, although his asphaltic wood pavement cost more at first, it was cheaper, over a lengthened period, than macadam, or most other roadways; and would compare favorably with other systems, in that and most of the requirements of a good modern roadway.

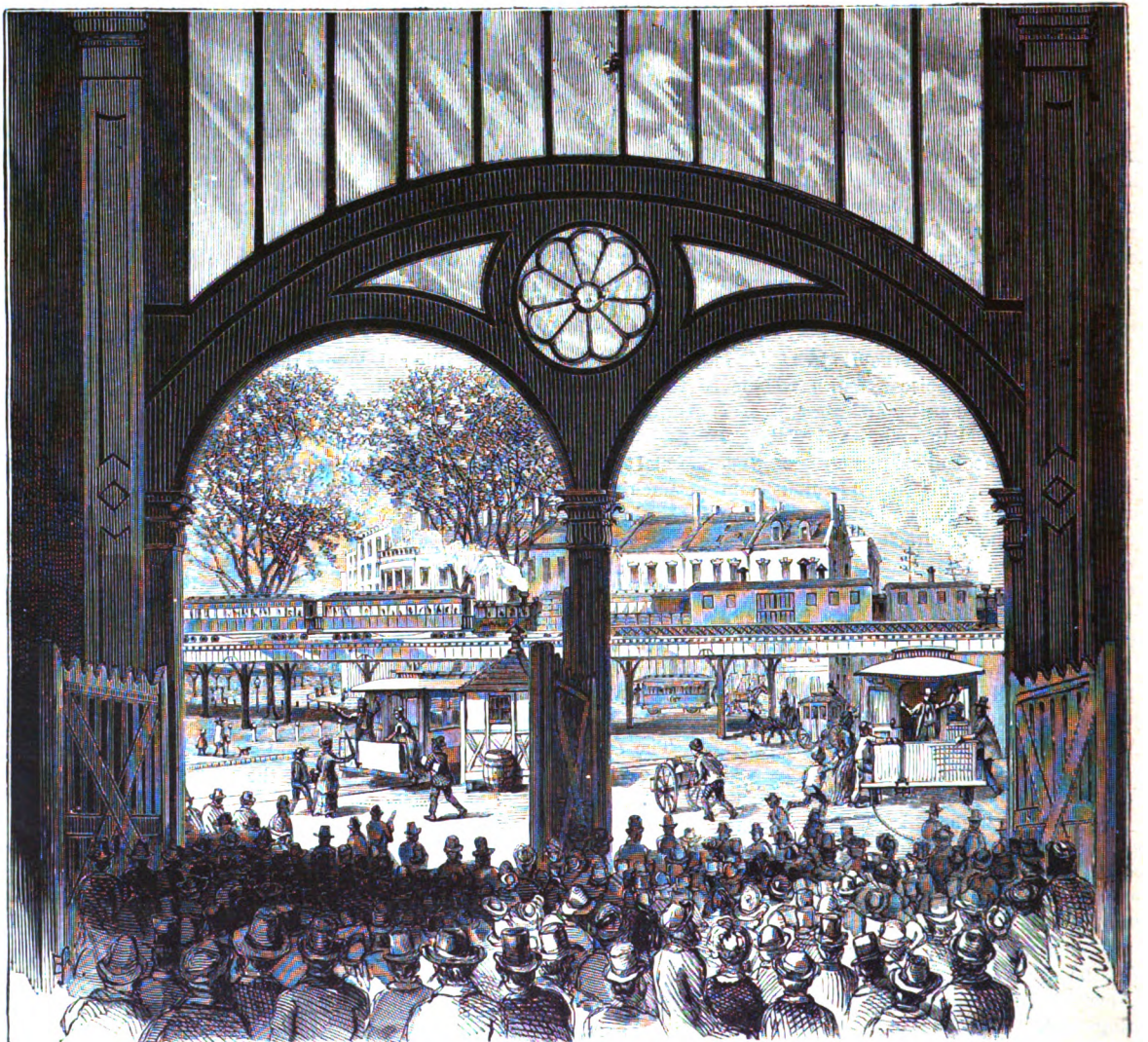


Fig. 5.—NEW YORK ELEVATED RAILROAD STATION AT SOUTH FERRY.

VERTICAL ENGINES AND BOILERS.

There are certain excellences sought after by nearly every builder of steam engines, namely, economy of fuel, regularity of speed, simplicity of mechanism, durability and freedom from derangement, power with a given size of cylinder and pressure of steam, and, lastly, elegance of design and finish.

In stationary and steam yacht engines we find an infinite variety of construction, some of unsymmetrical form, roughly constructed, with slight finish, and again others having every improvement that is considered really such by the designer, with elaborate finish and beautiful but simple mechanism. As an illustration of the latter class we have selected some engines constructed by the New York Safety Steam Power Company, of New York city. Fig. 2 represents a form of engine they construct for yachts and launches; the engraving is taken from one of ten horse power. Engines of this class are fitted with link motion for reversing, and are furnished with notches for working expansively. The outline of this engine is one of great elegance, and the disposition of the moving parts is compact without being too confined for examination and oiling. Fig. 1 represents the steam launch *Barrancas*, one of the many built by this company. This one was built for the Quartermaster's Department, U.S.A., and gives a very good idea of this class of boats. She is 61 feet long over all, 10 feet 10 inches beam over the fender strakes, 4 feet 6 inches draught aft. The after cock pit is 20 feet 6 inches long, and the forward one 11 feet long, the average width of both being 8 feet 6 inches. The total length of seating, including thwarts, is 78 feet. Fig. 3 shows a combined vertical engine and boiler which may be properly considered semi-portable. This form is suitable for a great variety of small industries to which motive power can be advantageously applied.

The engine is not fastened to or upon the boiler, and is, therefore, not affected by the expansion, nor are the bearings overheated by conduction or the ascending heat from the boiler. The boiler is a patented vertical tubular one, with internal fire box, and, we are informed, is made of the best material and workmanship. The heating surface and area of grate, it is claimed, are in excess of the quantities usually allowed for the same power. The engine and boiler are placed on a base, which also supports the boiler, forms the ash pit, and contains the feed water heater. A neat arrangement collects all the drip from the stuffing boxes, the bearings, and the pump, into one cup, where it can be conveyed away as desired. The exhaust steam is discharged through a blast pipe in the stack. The fly wheel being at the base secures steadiness under the high speed which is necessary for economy of fuel.

At the rooms of the Company, 80 Cortlandt street, New York city, are a fine stock of engines for various purposes, and numerous models of yachts, fast pleasure boats, and launches, some of them of unusually graceful proportions.

SCHOOL SHOPS.

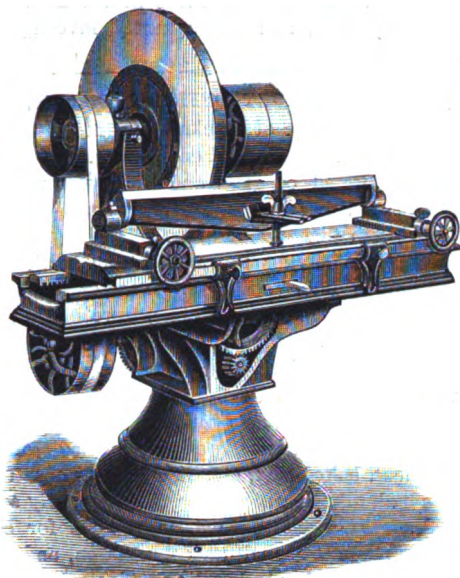
Not merely shops of the nature of the kindergarten for older children, or of affording the rudiments of a knowledge of the trades as now practiced in America, but shops affording a knowledge of the many practical industries not now established in America. Little shops which teach other uses of raw material than those now known, and incite to the establishment of work-shops which shall grow to great industries. One crying defect of the eager superficial system of most American teaching, either in books or schools, is that there are no handbooks of practical information from which a knowledge of the production of a great number of articles may be obtained. Since the labor societies and the compulsory school laws keep boys still more from apprenticeships, there should be a series of cheap practical handbooks within the reach of every boy, and, at the same time, so practical that a knowledge of the pursuit may be easily worked out.

Practical common sense shops, where a boy may earn his expenses and learn a trade, or, by paying for his night attendance, may learn the rudiments of any pursuit to such an extent as to be able to put his knowledge to practice. How few people in America know the nature and uses of clay, or know what clay is! Plaster of Paris, or how obtained, to say nothing of working it. Probably not one person in a thousand, in the United States, knows that placing a piece of limestone, so common all over the country, for an hour upon a coal fire, converts it into lime. This is not an isolated instance, but the rule is that the first rudiments of practical knowledge are not provided by books or schools, and until they are children will read trash and be

ignorant of the means by which they may be useful citizens.

IMPROVED AUTOMATIC KNIFE GRINDER.

We illustrate herewith a new grinding machine for grinding and sharpening planer, paper cutter, and other long



AUTOMATIC KNIFE GRINDER.

knives used by belt makers, curriers, rubber and paper workers, etc. It is claimed that a long knife can be fastened to the machine, adjusted, and ground perfectly straight in ten minutes. A solid emery wheel with iron center is used, working at a speed of 225 revolutions. The platen to which

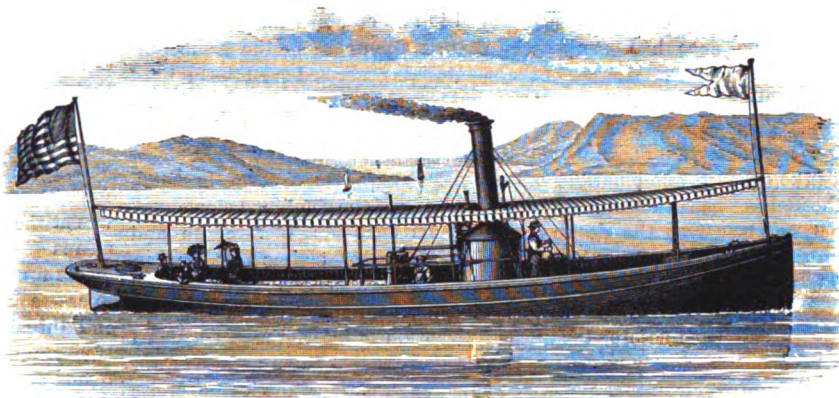


Fig. 1.—STEAM LAUNCH BARRANCAS.

the knife is bolted works similar to that in the metal planer, and can be instantly adjusted to traverse any distance from 2 to 36 inches. The advantage of the iron center is that it can be recovered after the wheel is worn down, thus saving the cost of a wheel of the size of the center. In this way only the emery actually used is lost. The present machine, we are informed, is manufactured with especial care.

All the gears are turned and cut; the spindle boxes are

of a number of pistons acted upon successively by steam or water, so as to revolve a common crank coupled to the pistons; and it consists of a casing with four interior cylinders at right angles to each other, and connected by a duct having suitable entrance and discharge valves. The four pistons are coupled to the wrist pin of a crank at the interior end of a shaft turning in a stuffing box of the cylinder casing.

Mr. Nelson McIntyre, of Princeton, Wis., has patented a handy Wagon Lifting Jack, which is self-supporting when the load is raised, and may be closed up in compact form for convenience in storage and transportation.

Mr. C. Palmer, of Springfield, Tenn., has invented a Machine for Sewing Brooms with Wires, consisting of a combination of mechanical devices for clamping the broom, holding the wire bands which surround the brush, guiding the transverse binding wires through it, cutting them, and binding them over the wire bands.

An improved Glove Sewing Machine, invented by Mr. C. M. Bolland, of New York city, belongs to that class of machines for sewing gloves, furs, and similar work, in which are employed two parallel feed disks, a reciprocating needle, and an oscillating looper. Special details are introduced, among which are an adjustable guide arm for laying over the seam one or more ornamental face threads, and a revolving brush to clear the edges of fur from hairs in sewing.

Mr. R. S. Munger, of Mexia, Tex., has invented an improved

Cotton Gin Saw Cleaner, consisting of a series of knives supported by a movable frame, which may be thrust between the saws, cleaning them rapidly. The knives are readily detached from their support when it is desired to sharpen them.

A new Nut Lock, patented by Mr. J. L. Hayward, of South Framingham, Mass., is formed of a thick rubber

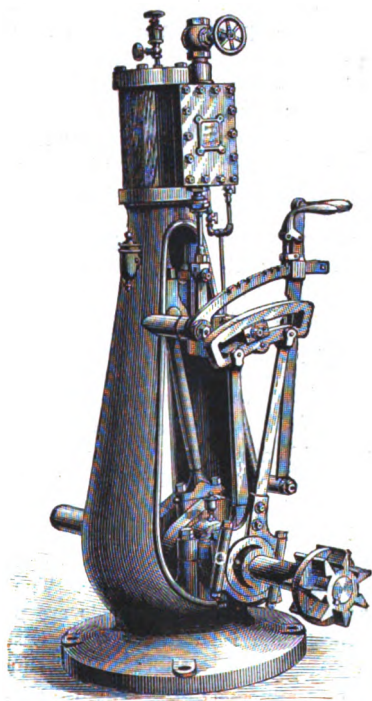


Fig. 2.—10 H.P. LAUNCH ENGINE.

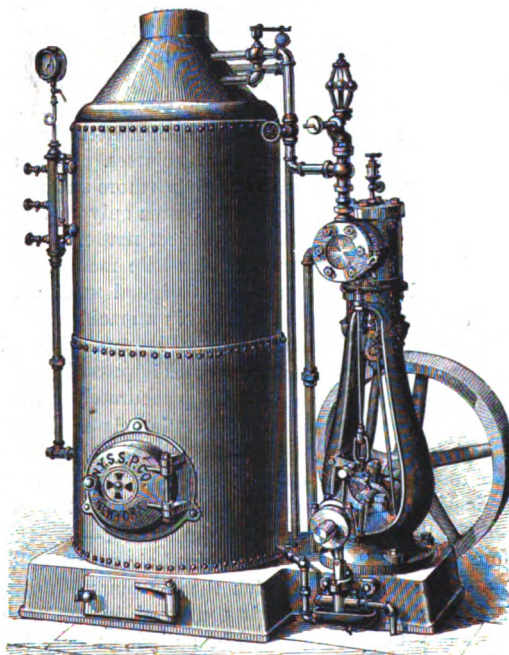


Fig. 3.—VERTICAL ENGINE AND BOILER.

made in halves (same as for engine lathes), and are also fixed and permanent, requiring no adjustment as the wheel wears down. The spindle and all the shafts are made from steel. The bearings are made very long, and all parts of the grinder are interchangeable.

For further particulars address the manufacturers, the American Twist Drill Company, Woonsocket, R. I.

London Water Works.

Nearly all the waterworks companies of the metropolis are actively engaged in providing a constant water supply, and the number of miles of streets which now contain mains constantly charged, and upon which hydrants for fire purposes could at once be fixed, in each district of the metropolis, is given in Mr. Frank Bolton's report for the month of March, as follows: Kent, 80 miles; New River, 196; East London, 85; Southwark and Vauxhall, 112½; West Middlesex, 70; Grand Junction, 41½; Lambeth, 70; Chelsea, 56; making a total length of 711 miles; the water companies are ready to affix hydrants thereon when required by the authorities. The total number of hydrants erected is at present 4,527, of which 2,818 are for private purposes, 542 for street watering, 697 for public use, and 475 in government establishments.

New Mechanical Inventions.

An improved Key for fastening the bosses of wheels and levers to their shafts has been invented by Mr. P. A. Oliver, of Wilkesbarre, Pa. It has a cylindrical threaded head, to which is fitted a sleeve or nut made externally polygonal to receive a wrench, by which it is turned in the operation of extracting the key.

A Spanish inventor, Señor Luis Ybarra, of Madrid, has introduced a novelty in Revolving Firearms, consisting in the addition of a special chamber for receiving from the rear end of the cylinder a portion of the gas resulting from the explosion of the cartridge, and conveying it to one of the discharged chambers, to expel the empty shell.

Mr. L. Murray, of Greensburg, Pa., has invented a Railway Frog, which, in its normal position, keeps the main line open, but yields sufficiently to the side pressure of the wheel flanges to open the side track for a train passing over it on that track. The tongue is pivoted to the bed plate, and its point is held to one of the main rails by a spring, to keep the main track open.

A new Channeling Tool, invented by Mr. C. K. Sharrod, of Detroit, Mich., belongs to that class of machines employed to cut a channel and groove, for the purpose of holding the thread or nails used in uniting the soles and uppers of boots and shoes. The feature of Mr. Sharrod's invention is a casting, adapted to be secured to the machine, having an inclined socket carrying a tubular cutter, which is adjusted by set screws as it becomes worn.

Mr. J. J. Peux, of Brooklyn, N. Y., is the inventor of an improved Crown Push for stem-winding watches, which is claimed to be so constructed as to render the crown entirely dustproof, prevent rattling, and permit the movement being taken out of the case without removing the crown or key pipe.

A novel Rotary Engine, the principle of which is also applicable to a pump, has been invented by Oscar Stenberg, of Helsingfors, Finland. It is based on the differential action

washer containing several steel pins, which are parallel with the axis of the washer, which, when the washer is compressed by the nut, act as pawls in preventing the nut from unscrewing.

Mr. S. F. Charles, of Cumming, Ga., has patented an Amalgamator of improved construction, intended especially with reference to saving "float" gold, in which the special feature is the use of a new amalgam cloth having silver amalgam and gutta percha in its interstices, claimed to be unusually durable and effective.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, June 15, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises.....	8 29 mo.	Jupiter in meridian.....	3 02 mo.
Venus rises.....	2 21 mo.	Saturn rises.....	0 33 mo.
Mars sets.....	9 37 eve.	Uranus sets.....	11 07 eve.
Jupiter rises.....	10 06 eve.	Neptune rises.....	2 09 mo.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises.....	10 34 eve.	Regulus sets.....	11 09 eve.
Algol (var.) rises.....	0 18 mo.	Spica in meridian.....	7 42 eve.
7 stars (Pleiades) rises.....	2 38 mo.	Arcturus in meridian.....	8 33 eve.
Aldebaran rises.....	3 57 mo.	Antares in meridian.....	10 45 eve.
Capella sets.....	9 40 eve.	Vega in meridian.....	0 59 mo.
Rigel rises.....	6 03 eve.	Altair in meridian.....	2 11 mo.
Betelgeuse sets.....	6 38 eve.	Deneb in meridian.....	3 03 mo.
Sirius sets.....	6 04 eve.	Fomalhaut rises.....	1 18 mo.
Procyon sets.....	8 15 eve.		

REMARKS.

The sun attains his greatest northern declination (23° 27' 24") and enters the constellation *Gemini* (sign *Cancer*) June 21, at which time summer begins. Mercury will not be visible until about August 10. Venus and Neptune are in conjunction June 11. At the time Venus rises Neptune will be about ½° northwest of her. This will be a good opportunity to search for Neptune. Jupiter is in conjunction with the moon June 18, 1h. 3m. morning. This is an occultation on this continent between 24° + and 55°—latitude, and here will be almost a contact of limbs, Jupiter being north of the moon. His fourth satellite disappears in an eclipse June 9, 11h. 33m. evening, and reappears at 8h. 43m. morning, 10th, having passed through the planet's shadow in 4h. 10m. This and all other eclipses of his satellites must take place at the west of the planet until July 25. At the moment of the disappearance of this satellite the third one is behind the planet, the second has just appeared from behind the planet, and is close to him upon the east, while the first has recently made a transit and is quite near him upon the west. For an inverting telescope reverse these directions.

Singular Effects of Carbon in a Blast Furnace.

In a communication to the Lafayette Chemical Society of Lafayette College, Easton, Pa., Mr. J. Gayley states that in November, 1877, the blast was taken off No. 4 Furnace at the Crane Iron Works, Catsauqua, Pa., for which he is chemist, in order to place in position a new bell and to repair the arch of the gas flue leading to the boilers. The bricks forming the arch of this flue, from some cause unknown, had become disarranged to a great extent and were apparently ready to drop at any moment, so that it was found necessary to take down a portion of the furnace lining. The inner circle of fire brick in the upper portion of the furnace was protected by a cast iron casing, covering the exposed ends and under surfaces. At a distance of 8 feet from the furnace top, filling in between the iron casings above and the fire brick below, was found a large deposit of carbon. This deposit did not occur in isolated spots, but rather uniformly distributed throughout the layers as far as we had opportunity to observe; whether it extended to a greater depth, or the whole distance round the furnace, I am unable to say. The position of the deposit was on the front, or the side of the furnace receiving no blast, and almost directly underneath the gas flue. The courses of brick on this side of the furnace were distorted to a great extent and elevated several inches above those on the opposite side. Thus it seemed that the carbon had exerted a physical force, causing the displacement in the furnace lining and in the arch of the gas flue. No deposit was found beyond the inner circle of fire brick, as the iron casings only extended this far. When taken from its position the mass of carbon was seen to glow, a partial combustion taking place on the surface, converting the small particles of metallic iron or lower oxides distributed throughout the mass into the peroxide. This is readily seen on examining the lumps, where on the surface small particles of the peroxide of iron are noticed gradually decreasing as we go in and finally disappearing in the interior. The carbon was found principally in the form of a powder, but occasionally aggregated into lumps; it had a uniform black color, and when rubbed on the hands resembled powdered graphite. It absorbed water readily and was slightly attracted by the magnet. The total amount of metallic iron was determined in samples taken from different portions of the mass. Two samples of the fine portion taken from different places yielded, on analysis, 4.23 and 3.23 per cent of metallic iron. The interior of one of the lumps was also analyzed; the total amount of metallic iron it contained was 2.56 per cent; 0.35 of this existed as metallic iron, the remainder, 2.21 per cent, was combined as an oxide. The substance was free from cyanogen and chlorine. The cause of this formation was evidently due to the presence of the iron casings, as we do not find the deposit beyond the

point where they extended. In the "Transactions" of the American Institute of Mining Engineers, vol. ii., Mr. Frank Firmstone called attention to a similar deposition of carbon in the blast furnace, but I do not know that the occurrence is usual. The cause of the deposition of the carbon in the furnace at the Crane Works was doubtless the iron casings, which, when partially oxidized, effected the decomposition of the carbonic oxide in the manner first pointed out by Bell, and subsequently investigated by Gruner.

NOTES OF PATENT OFFICE DECISIONS.

In the interference case of Blackman vs. Morray, the subject matter involved was a burial case, the entire top portion of which was formed of glass and the lower portion of cement, the two being joined by tongue-and-groove and cement joints, also flanges and bolts.

Evidently coffins having top and bottom sections, with tongue-and-groove interlock joints, the sections being made wholly of cement, terra-cotta, or glass, were old in the art. The patent of J. R. Cannon, of October 25, 1859, No. 25,883, was for a glass burial case in two parts, upper and lower, which were hermetically joined "by tongue-and-groove and cement joints, also by flanges and bolts." Mention may also be found in nearly every cyclopedia of coffins made of cement, baked clay, etc. Patents for constructing coffins from hydraulic cement were granted as early as 1835, and subsequently patents have been granted for cement coffins, coffins made of asphaltum composition, and for peculiar cements for coating and sealing coffins. David Sholl, March 25, 1855, was granted a patent for "a coffin composed of terra-cotta or pottery ware." Glass lids to coffins were also notoriously old.

It was insisted, however, that by the combination in interference, there had been united for the first time in a coffin the element of strength or indestructibility and the element of transparency—a non-breakable coffin capable of wear and transportation, and at the same time having a transparent lid. The commissioner, however, held that cement and glass employed in the combination in interference had been previously used for precisely the same purposes. Neither of these materials possessed even the merit of being put to a new use, but were simply employed in juxtaposition, and each performed precisely the same functions as before. The result, evidently, was not the product of the combination, but a "mere aggregate of several results, each the complete product of one of the combined elements." Given the desire to unite the elements of strength and transparency in a coffin in the manner claimed by the parties in interference, and the materials and method were at once found in that very art. Compared with what existed before, the alleged invention in interference consisted in simply selecting proper and well known materials for their proper and well known uses, without the least exercise of the inventive faculty. The interference was accordingly dissolved by the commissioner, and the application for a patent rejected.

In the interlocutory appeal from the decision of the primary examiner in the matter of the application of R. W. Hamilton, for "independent condensing mechanism for steam engines," the question at issue related to a division of the application. The examiner decided that each of the combinations separately claimed in this application should be the subject of a distinct application, on the ground that they were distinct inventions relating to well recognized classes.

Such questions are not easy to decide, as the Patent Office, on the one hand, should avoid imposing any hardship upon an applicant by requiring separate applications for what might be included in one, and, on the other hand, must avoid the confusion which would, in the present condition of the arts, necessarily result from indiscriminately including in one patent matters known and recognized as belonging to distinct classes. In an advanced state of the art subdivision becomes more and more necessary, and that which was before known only as a part of a machine may become a distinct subject matter of improvement not relating directly to the whole machine, but specifically confined to a part of the original machine, and applicable to that part, whether used in a machine of one class or another. If such matters are not kept within well defined limits of classification, it becomes impossible either for the Patent Office or the public to keep accurately advised as to the state of the art in any particular class. In the case under consideration the applicant stated that his invention related to an independent condensing mechanism which could be attached to and used in connection with any ordinary steam engine. His first claim was for—

"A combined air pump and condenser for steam engines, in which the air pump, constructed and arranged as set forth, is contained in the base of the condenser, and is operated by an independent steam cylinder."

The second claim was for—

"The water-packing space, Q, around the plunger of the air pump, in combination with the pipe, M, leading from the condensing chamber, or other equivalent device for supplying it with water."

M was the pipe to carry the water from the condenser to the water packing space; but under the phrase "other equivalent device," anything which would bring the water to the packing space might be included.

The examiner therefore held that this claim was for no more than the simple packing, applicable to pistons in va-

rious uses, and belonging to a distinct class of inventions, and this decision of the examiner was affirmed by the commissioner.

Amending the Patent Law.

One of the provisions of the bill pending in Congress to amend the patent laws is that, in a suit by a patentee, "the defendant shall not be charged with any savings he may have made if he shall show that the use of the patent has not enabled him to realize an actual profit in that part of the business connected with the use of the invention."

That is, if a man steals property, or takes it without the owner's permission, he shall not pay for the use of it unless he has made it profitable to his business. This is an illustration of the spirit of the parties who devised the bill. It is a principle of confiscation. Said a prominent superintendent and a member of the Western Railway Association, "When our attention is called to a patent of value we use it, and in a few cases we are made to pay by plucky inventors; but, in the aggregate, we pay much less than if we took licenses at first."

It is most extraordinary that this association is organized to such an extent on the principles which govern the bandit. Calling on the State and national governments with success to protect their property from the confiscation of strikers, the companies in this association turn round and adopt the principle of the strikers' organization, make organized war on the rights of inventors, and cause a bill to be introduced into Congress to help them in their confiscation.

If every feature of their wretched policy cannot be eliminated from the bill, it ought to be defeated. Some small politicians have introduced resolutions into conventions in deprecation of the rights of inventors. They belong to that destructive set of political economists which maintain that the gain of one man or community must be from the robbery of another. It is nearly extinct, but disciples of every absurdity occasionally reappear.—*Eric Morning Dispatch*.

Professor Henry's Successor.

The Board of Regents of the Smithsonian Institution has elected Professor Spencer Fullerton Baird as the successor of the late Professor Henry in his position of secretary to that institution. The new secretary is a member of the National Academy of Sciences, and has been for several years the Assistant Secretary of the Smithsonian Institution, and is perfectly familiar with all the plans and purposes of the late secretary for carrying out the designs of its founder. There was at the beginning considerable discussion as to the best means of conducting the institution so as to meet the wish of the founder, which was, according to the terms of his will, to create at Washington "an establishment for the increase and diffusion of knowledge among men." This Professor Henry understood to mean not merely the increase and diffusion of already existing knowledge, but that it would include the discovery and diffusion of new truths as well. There was some difference of opinion on this point, but Professor Henry's ideas finally prevailed, and the institution has been so conducted as to spread the knowledge obtained through its researches and the aid of its funds over the whole world, rather than to benefit Washington and its surroundings, or even the United States. This policy, it is believed, the new secretary will continue.

Professor Baird was born at Reading, Pa., in 1823, and is consequently fifty-five years of age and in the full vigor and prime of manhood. He is a well versed naturalist, and by talent and experience is eminently qualified for his new post of duty.

American Exports and the Strikers in England.

Consul General Badeau at London has sent to the Department of State a dispatch relating to the disastrous strikes of British operatives and the influence of the competition of American manufacturers in the markets of England. In the discussion between the cotton manufacturers of Lancashire and the weavers now on strike there, and in the comments of the press thereon, it is generally, although unwillingly, conceded that a potential influence has been exerted by American competition in diminishing the English cotton trade at home and abroad. England now sends to this country less than one third the quantity of goods she sent in 1860, while, on the other hand, it is stated that 30,000 pieces of cotton goods have been shipped weekly to England for two or three years from New York and Boston. Some say that these goods have been sold at a loss to realize cash, but this is denied by good authorities, who admit, however, that the profit is but small. The London *Times* attributes the increase of American manufactures at the cost of British industry to the superior quality and equal or cheaper prices of American cotton, besides general domestic advantages in process of manufacture. The *Saturday Review* declares that American products are profitably competing with British goods, not only in the Eastern markets but in England itself, and attributes the decline of the Eastern trade to the "fraudulent folly of English manufacturers, who have lost their customers by palming off on them adulterated goods," as well as to the fact that the American cotton manufacturers can produce at a less cost than the British. General Badeau advocates the policy on the part of American manufacturers of carefully maintaining the superior standard of their wares, and selling at low and comparatively unremunerative rates for a time, by which means, added to our natural advantages, a still greater share in the coveted trade, if not in England, certainly in China and Japan, may be diverted into American channels.

METHOD OF CORRECTING A LEADING SCREW.

BY JOSHUA ROSE, M.E.

It was recently required, when cutting a new screw at the Pratt & Whitney Company's works, to correct the error in the lead screw of the lathe in which the new one was to be cut. This was accomplished by employing the device shown in our engravings, and which was designed by Mr. A. Swasey. It was first ascertained by testing the lathe that its lead screw was too short by $\frac{1}{100}$ of a revolution in a length of 2 feet, the pitch of its thread being 6 to an inch. Now in 2 feet of the screw there would be 144 threads, and since $\frac{1}{100}$ (the part of a revolution the thread was too short) $\times \frac{1}{6}$ (the pitch of the thread) = $\frac{1}{600}$ (which was called $\frac{1}{600}$), the error amounted to $\frac{1}{600}$ inch in 144 turns of the screw. The construction of the device employed to correct this error is as follows: In Figs. 1 and 2, A represents the bearing of the feed screw of the lathe, and B a sleeve, a sliding fit upon A, prevented from revolving by the pin, *h*, while still having liberty to move endways. C represents a casing affording journal bearing to B, having a fixed gear wheel at its end, *c'*, and an external thread upon a hub at that end. D is the flange of C to fasten the device to the shears of the latter, being held by screws. E represents an arm fast upon the collar of the feed screw, and carrying the pinion, F, the latter being in gear with the pinion, C', and also with G, which is a pinion containing two internal threads, one fitting to B at *b*, Fig. 2, and the other fitting to C at *c'*, Fig. 2, the former having a pitch of 27 threads to an inch, the latter a pitch of 25 to an inch.

The operation is as follows: The ordinary change wheels are connected to the feed screw, or lead screw, as it is sometimes termed, at J in the usual manner. The arm, E, being fast to the feed screw will revolve with it, and cause the pinion, F, to revolve around the stationary gear wheel, C'. F also gears with G. Now F is of 12 diametrical pitch and contains 26 teeth, C' is of 12 diametrical pitch and contains 37 teeth, and G is of 12 diametrical pitch and contains 36 teeth. It follows that the pinion, F, while moving around the fixed gear, C', will revolve the pinion, G (which acts as a nut), to an amount depending upon the difference in the number of its teeth and those of fixed gear, C' (in this case as 36 is to 37), and upon the difference in the pitches of the two threads, so that at each revolution G will move the feed screw ahead of the speed imparted by the change gears, the end of the sleeve, B, abutting against the collar, I, of the feed screw to move it forward.

In this case there are 36 turns of the feed screw, A, for one turn of the nut pinion, G, the thread on sleeve, B, being 27, and that on the hub of C being 25 to the inch; hence, 36 turns of the feed screw gives an end motion to the sleeve, B, of $\frac{1}{27}$ minus $\frac{1}{25}$ = $\frac{2}{675}$, and $\frac{2}{675}$ of that = $\frac{1}{337.5}$ of an inch = the amount of sliding motion of the sleeve, B, for each revolution of the lathe feed screw. By varying the proportions between the number of teeth in C' and G and the pitches of the two threads in a proper and suitable ratio, the device enables the cutting of a true thread from any untrue one in which the variation is regular.

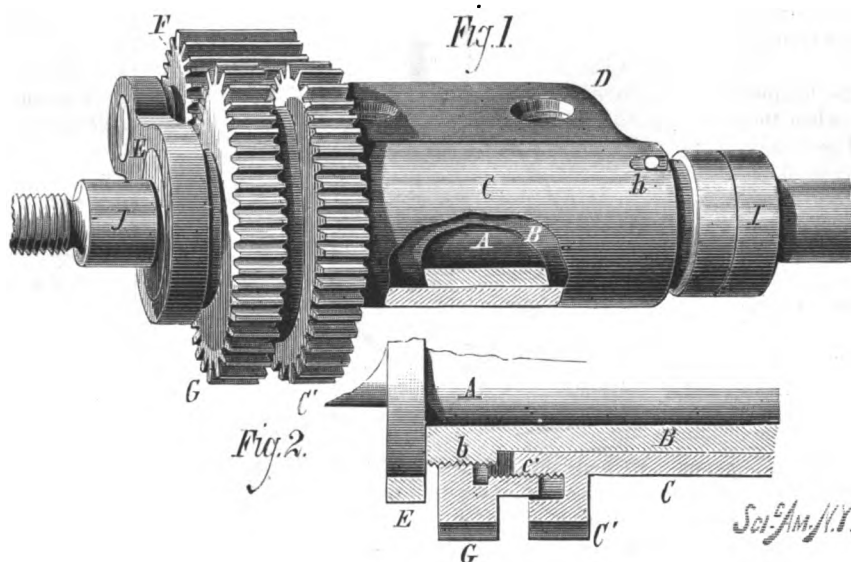
About Sugar.

Strawberries contain 5.86 per cent of their weight of glucose, cherries 10, white currants 6.40, and hothouse grapes 18.37; pineapples, on the other hand, contain 11.33 per cent of cane sugar, apricots 6, and oranges 4. The sugar cane, when perfectly ripe, contains 18 per cent of sugar. The juice of the sugar beet contains about 14 per cent of sugar. In Havana we learn that there is one cane factory capable of producing 125 tons of sugar per diem. In many factories the use of blood is now entirely dispensed with, though great care is required in the management of the filtration.

FIREWORK MAKING.

This art is, if not really a secret one, very little known to the general public, owing to the danger attending the manufacture, which prevents casual visitors inquiring, and to the nature of the product, which offers no inducements to the analyst.

In calling special attention to pyrotechny as an art well worth cultivating, even although apparently an expensive luxury, we desire to laud the wondrous æsthetic effects of light and color, rather than the mere detonations calculated to impress the savage or the uncultured.



DEVICE FOR CORRECTING A LEADING SCREW.

It is a matter of great regret that the results of the pyrotechnist's art are so evanescent, not even ephemeral, but almost instantly vanishing. The stately rocket and its comet-like tail of soft fire, the fiercely hissing gerb, the detonating bomb, and the fountains and myriad devices delighting with swift surprises in coruscation, steady glow, flashing, gleaming, and waning—all minister to our sense of the beautiful, and are well calculated to arouse and to maintain enthusiasm in the cause in which they are offered in honor.

It is our purpose to approach within the precincts, and analyze the modes by which all these effects are produced. It must be premised that the manufacture is dangerous to

strips rolled around a wooden mandrel. These cases are filled with "compositions" made of "meal powder" (that is, ungrained gunpowder) mixed with various ingredients.

In some "pieces" there is required "force;" in others, color. In the rocket force is most needed; in the Bengal light, color. Roman candles need force and color alternately. For all, the cases need to be light and strong, and it is desirable to have the powder burn as long as possible.

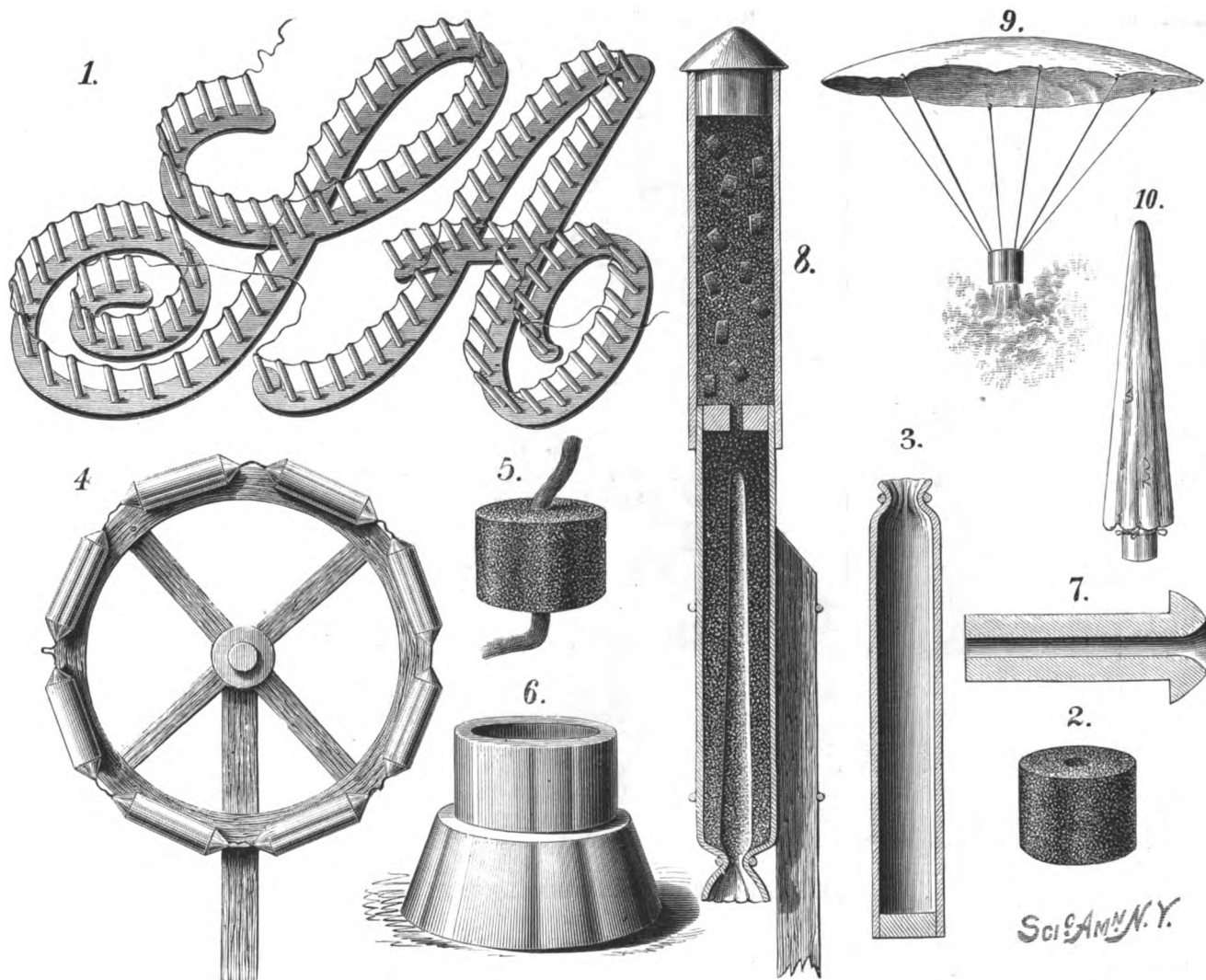
The meal powder is made of sulphur, niter, and charcoal. With this are mixed, according to the result desired, filings of cast and wrought iron, steel, copper, and zinc; dust of camphor, rosin, or lycopodium. To get the brightest red and white sparks, long iron filings free from rust are needed; for brilliant fire with radiations or coruscations, steel filings and cast iron borings. Green flames are given by copper; pale green, by verdigris; palm green, by blue vitriol (sulphate of copper) and by sal ammoniac. Blue is given by zinc; better blue, but with more smoke, by sulphuret of antimony. Yellow comes from amber or rosin, or dry salt. Lampblack makes gunpowder flame red, which an excess of niter tones down to pink. Camphor is used to give an intense white flame; also to give aromatic odors, as do benzoin and storax. Lycopodium gives magnificent rose-colored flames. Hundreds of formulas are given in Spon's "Workshop Recipes" and other works.

The simplest element in pyrotechny is the small paper case called a "lance," used by hundreds in "set pieces." Lance are quills or thin tubes (say 5 inches long) of about $\frac{1}{4}$ inch bore, and tightly rammed with a color composition. These are closely fixed perpendicularly to frames of desired outline, and their outer ends connected by a quick match so that all burn at once. They should burn about two minutes. The sketch, Fig. 1, shows how a "set piece" would be made.

The large Bengal light case should not burn; and is rammed with color composition. The Roman candle case is thicker and still stronger. It is packed with alternate layers of color, "stars," and projecting compound; the design being to burn with color, and then to shoot out a star which shall burn in the air while more color is burning at the case. The American star, Fig. 2, is a hard dry wad of coloring composition about half an inch each way, and pierced so as to burn inside and out. The English makers make their stars of short thin paper cases, open at each end; or if desired to be changeable, open at one end only, and rammed with two layers of color composition. The star rests on a layer of projecting powder, which sends it out and lights it at the same time.

The gerb, Fig. 3, is a thick strong case, packed with projecting composition. It is "choked" at one end, so as to give a smooth small outlet for the gases, and thus give them more force. Gerbs are fixed tangentially on a free wheel, Fig. 4, which their combustion causes to rotate. The "choke" is effected when the case is wet, by making one turn of a strong cord near the mouth, and pulling strongly.

The "bomb," which is a magnificent and effective sound and color piece, very expensive, is a hollow sphere of zinc or paper (made in halves and pasted together with muslin), filled with stars just like those for



DETAILS OF FIREWORKS.

all concerned in it, principally from the liability to accidents caused by careless strangers. Hence it is secluded and shrouded in mystery. The operatives should be well separated by open space to prevent a petty accident causing a general disaster. There are few, if any, complicated or costly machines. Tables and vises, pans and sieves, paste-pots and twine, and a stove, compose the principal "plant."

Nearly all fireworks require paper cases—made of pasted

Roman candles and rockets, save that each has a fuse extending through it, Fig. 5. A small quantity of gunpowder among the stars causes the shell to burst and lights the scattering stars. The bomb is fired either from an iron mortar or off a "block," Fig. 6, which is a wooden breech on which a temporary paper barrel is put. There is a "dish" in the top, a little powder is laid in this, the bomb on this, the paper barrel slid over the bomb, and the charge fired. A

time fuse, Fig. 7, page 878, in the shell, explodes it at the proper point in its flight. A 3 inch shell contains 48 stars; 6 inch, 432; 8 inch, 1,674; 10 inch, 3,150; 12 inch, about 5,000!

A rocket, Fig. 8, is at once a highly scientific device and a work of art. It must be light, strong, steady, and high soaring; and it is sometimes demanded that it explode and liberate stars, or a parachute with a pot of colored fire. The conical cap is of no use, being merely a commercial "finish." There is a hard, thick, well choked paper case, rammed tight with projectile composition, but having a central conical bore left, so that the composition burns along the whole length of this bore, and most freely toward the end of its flight. If it be intended to explode at the end, there is a compartment filled with explosive powder, and with stars if desired, a pierced clay wad separating this from the regular filling.

The "parachute," Figs. 9 and 10, is a muslin circle, having suspended from it a "fire-pot," which is lighted when the rocket explodes and the parachute is set free. The rocket stick is merely to balance and guide it. Rockets are used for throwing life lines to wrecks, and recently for carrying charges of gun cotton up into the air so as to explode over any locality where it is intended to give a warning. Some strong rockets can soar nearly a mile in height.

A tourbillon is a case filled with projectile compound, and having its lower and lighted end pierced with spirally inclined vent holes, which cause it to ascend and revolve.

While at first thought a pyrotechnic display appears to be a very expensive luxury, it must be remembered that by no other means can an immense concourse be pleased, and that a display costing even \$10,000, if witnessed by say 250,000 people, figures up to but four cents a head for two hours' varied and unceasing enjoyment.

THE GLASS BALL CASTER.

The illustration herewith presented represents the tasteful exhibit at the Paris Exposition of the Adgate Glass Ball Caster, an exceedingly ingenious contrivance which offers many advantages over the roller caster in common use. The construction of the device embodies little that is not seen at a glance. A glass ball, of size varied according to the weight of the article of furniture to be supported, is held in claws which are cast upon a shank, which last either slips into the leg of the piano or other object, or is attached to it by screws. The mode of attachment, in fact, is the same as with the ordinary caster. As of course the ball touches the inner sides of the claws only at points, at these places metal projections are provided, and directly under the shank is inserted a piece of bone, as shown in the small engraving. This reduces the friction between the ball and its holder.

The chief points of merit of this caster are its strength and remarkable ease of motion. When supported on roller casters a heavy piece of furniture when pushed usually moves in any direction but the one desired. With this caster the object is at once caused to travel as desired. The weight being placed directly above the ball, no leverage is exerted as in the case of the roller caster to twist off arms or break the shank. The ball being perfectly smooth leaves no mark on the softest carpet, nor can it become jammed so as not to roll. The friction between ball and carpet is thus very small and the wear of the latter reduced to almost nothing. For pianos, we are informed, this caster has proved especially suitable not merely in rendering them more easily handled, but, according to the testimony of Mr. S. B. Mills and other well known performers, it very greatly improves the tone of the instrument. Patented April 2, 1878.

For further particulars address the manufacturer, Mr. Charles E. Parent, 96 John street, New York city.

Firing Guns under Water.

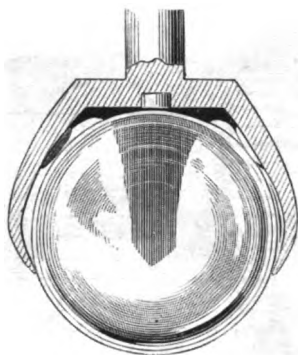
Dr. H. A. Mott, of this city, has recently conducted a series of interesting experiments on the range of small arms when fired under water, his object being to determine whether this mode of testing could be used instead of the usual practice of firing the weapon in the air. He finds that the United States Army rifle is capable of projecting a bullet through water for a distance of 4 feet $1\frac{1}{4}$ inch, which corresponds to an air range of 3182.54 feet. The travel of a bullet one quarter inch under water is equivalent to a flight of 16 feet in the air.

Dr. Mott concludes that by this mode of investigation range and penetration can be arrived at with the greatest precision, and by the same means can be determined the value of the numerous gunpowders in the market in point of maximum and minimum effect, the best weight of bullet for a given weight of powder, and the best length of barrel

and size of bore for a given weight of powder and bullet. All these observations can be carried on in a room less than 10 feet square. Dr. Mott's report of his investigation, with tables, etc., will be found in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 127.

Oleomargarine Under the Microscope.

Mr. Thomas Taylor, the microscopist of the Department of Agriculture, at Washington, has been examining under the microscope and comparing different specimens of butter obtained in the markets of that city, with the view of determining the difference between pure butter and that made from oleomargarine, or butter made by churning fat with



THE GLASS BALL CASTER.

cream. He finds that, when viewed under the microscope, pure dairy butter presents a uniform appearance as far as color is concerned. The forms seen consist of oil globules and the crystals of common salt. When viewed by polarized light very little change of color is observed; but when a specimen of oleomargarine is examined in the same manner, the field is speckled all over with shining particles which change color with every quarter turn of the analyzer, and Mr. Taylor has demonstrated that these glistening points consist of crystallized fat. In using a power of about 250 diameters, animal tissue is also seen more or less over the whole field, and a thin sheet of the fat placed under a power

assertions made by the oleomargarine manufacturers as to the perfect purity of the fats used by them are not altogether correct.

From this it would appear that oleomargarine may be easily known from butter by the aid of the microscope, and that any impurities in the fats of which it is composed may be readily detected; and that it would pay large consumers of butter to microscopically examine their purchases so as to be certain of the quality or purity of the article they buy for butter.

THE INDUSTRIAL WEST.

With the oversupply of labor and capital in the East it is natural to look to the great teeming West for an outlet for the surplus labor and for the employment of capital in great enterprises and achievements. The "West," that is, the great basin east of the Rocky Mountains and west of the Alleghenies, holds a variety of resource and offers an opportunity for industrial employment not elsewhere found in the world.

Bound by ties of blood in a common brotherhood, connected by the iron pathways, and associated in trade and commerce, and political and social emulation, the East looks westward for her provisions and raw material, and for a market for her surplus and the employment of her overflow. How far is the world justified in its expectations of the West, and how much of hope is there of its industrial future?

The West has just felt the full force of the wave of disruption and disaster which followed the period of inflation succeeding the war. Not until within the past six months has the foreclosing of inevitable results fallen in its full effects upon the industries of the central western country. Some premonitions the West had from time to time in the disasters east of the Alleghenies, and the long shadows those troubles cast westward; but the disruption and disturbance of all fixed foundations and prospects have but come while the East is settling up old scores and reawakening to industrial prosperity. In the past six months the great iron works of the West have felt the force of the slackened demand for their products, and the heavy decline of the price of goods consequent upon the lower scale of manufacture and the almost bankrupt disposal of material. The great shops which are not

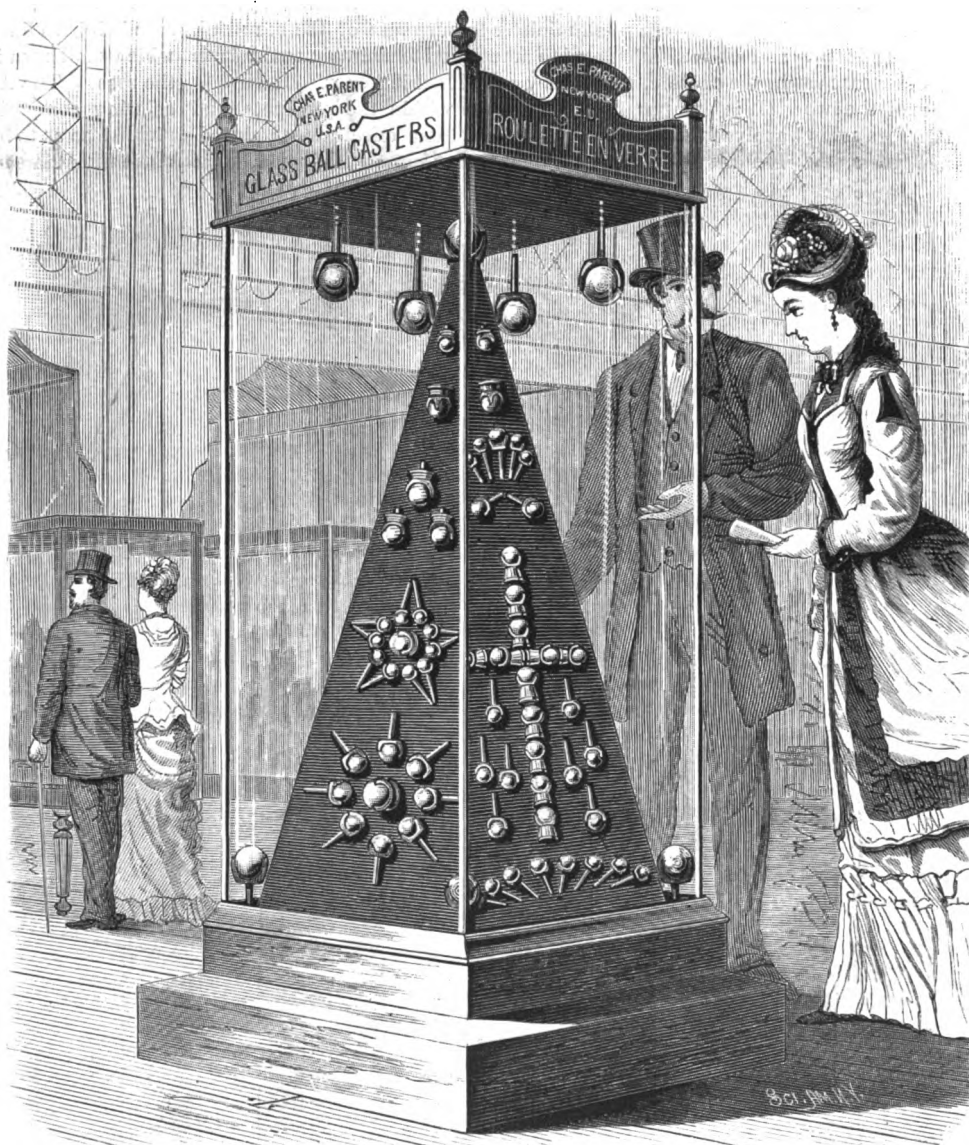
idle are too nearly so to allow of profit, and to keep the plant in operation so as to avoid the loss of rust and waste in idleness is about the only effort. This is not the condition in a few instances, but in all the West beyond Pittsburg. The large shops at Chicago and vicinity, at Indianapolis, Cincinnati, and Cleveland, and especially at St. Louis, are idle or but partially in operation. In Chicago and St. Louis the suspension or winding up of more than half the banking institutions shows the pressure the country has had to meet.

Nor are the iron works the only ones. Every industry in the Mississippi basin has had its share of the disaster. That the wave of difficulty is over is more than probable, for there is no fuel upon which the element can feed; it has spent itself, and the tide of recuperation is slowly at work. The foundation upon which the future prosperity of the West is to be built is about all there is existing; but the foundation is firm, and the dear school of experience has been passed through, and the people have the knowledge and hold it worth all it so painfully cost.

What is to be the future of the West, and upon what basis of enterprise and achievement their prosperity is to be built, can be only partially intimated. The first principle is the value to be derived from and the dependence to be placed upon her broad, unobstructed agricultural advantages. No other nation or locality has such resources and advantageous opportunities to begin with, and we are satisfied that the heaven of scientific cultivation now slowly working is soon to produce astonishing results in the great West. Not one half the fertile land of Ohio, Indiana, and Illinois is yet under cultivation, while but half the returns from the soil are received of which the land is capable. More labor

will soon be given so ten acres than one hundred now receive, and the profits will be proportionately high.

Next after the agriculture the mineral resources of the West will yet be scientifically developed, and that to a proportionate profit. All other things upon the earth and in and under it are for the service of the farmer's pursuit, and in no part of the world is it so apparent as in the central Western States. No people can have more than they produce, and we are satisfied that no part of the world will take more interest or more pride in the development of their home resources to their utmost than the West. We are satisfied, too, that the central West is to be the great inland industrial empire of the world.



THE ADGATE GLASS BALL CASTER.

of about 75 diameters exhibits the polarized light beautifully, each solid fat cell showing all the colors of the rainbow; and on turning the analyzer or polarizer the changing complementary colors are exhibited. The process of grinding the fat by means of rollers destroys the solid crystalline cell contents; but the glistening appearance remains the same under polarized light, only subdivided, as a natural consequence.

One specimen of the oleomargarine butter examined by Mr. Taylor was highly charged with animal tissue and the urate of magnesia, the crystals of which were well defined, showing that the fat used in this case was impure and probably that of a diseased animal, which would seem to prove that the

THE PRAIRIE DOG AND ITS UNINVITED GUESTS.

The prairie dog (*Cynomys ludovicianus*) of the Missouri region, and westward and southward, belongs to a genus of American rodents intermediate between the marmots and prairie squirrels. This woodchuck in miniature is about 13 inches long, with the tail 4 inches more; the color above is reddish or cinnamon brown, with lighter tips to the hairs, and a few black ones intermixed; beneath, brownish-white or yellow; tail like the back, with a black tip. The cheek pouches are very rudimentary, the eyes large, and the ears very short. The prairie dog was probably so named from the sharp tone of its chattering, somewhat resembling the yelp of a small dog, as it bears no external resemblance whatever to the dog. It is the *petit chien* of the French Canadians, and the *wish-ton-wish* of the Western Indian.

These interesting animals live in burrows, and great numbers are found in the same locality, forming communities which the hunters call "dog towns." These villages often extend over a distance of several miles.

Before the entrance to each burrow there is a little conical mound of earth, heaped up to a height of about 18 inches, and, on the top of this, one of the occupants may usually be seen sitting, intent on watching what is going on in the community, or on the lookout for intruders. At the first alarm caused by an intruder, a general scampering takes place throughout the village, with cries of warning. Upon reaching their mounds they sit perfectly quiet, like so many sentinels, curious to know what all the commotion is about. At a further alarm they approach still closer to their entrances, ready to dive in, and appear to make vehement threats, throwing up their tails in a very comical manner with each energetic bark, accompanying this noisy chattering with a liquid gurgling sound. In a twinkling they disappear into their burrows in a ludicrous, tumbling manner, and then, after a short time, they may be seen here and there peeping out to see if the coast is clear. Like young pups, they are very clumsy in their movements, and when (as rarely occurs) they are surprised at a distance from their burrows and find they cannot escape, they assume an air of audacity, and a most singular expression of defiance or of impotent anger, before allowing themselves to be captured.

They feed chiefly at night, their food consisting almost exclusively of grass and succulent stems. In the fertile lands of Central Kansas, they sometimes prove terrible pests to the farmers in the sad havoc they make among the fields of growing corn.

Squirrel-like, they are prudent enough to lay up a full supply of provender to last them through the long and rigorous winters they often have to endure. It is said that late in summer one may frequently meet with burrows around the entrance of which, for some distance, the grass has been

neatly mown and left to cure; and that, a few days later, the hay will be found to have been cleanly gathered up and carried into the burrow.

One of the most curious things in regard to the domestic economy of this little animal is that of its strange companionship with such undesirable guests as the burrowing owl and the rattlesnake, both of which are usually found inhabiting its abode. As to the owl, it is there like other parasites, perhaps, on sufferance merely, and very little notice is taken of its presence by the dog. Yet that the presence of the intruder is not always agreeable is proved by the fact that the

are found in communities by themselves, in the deserted villages of the prairie dogs, their presence in many cases having served to drive the rightful proprietors from their dwellings.

With regard to the rattlesnake, nothing of a satisfactory nature is known as to the part he plays in the domestic arrangements of this interesting community. Mr. Kendall, in his narrative of the Santa Fé Expedition, says that the prairie dogs are "compelled to let them pass in and out without molestation." Certain it is that, although the relations of the snake with both the dog and the owl are not all friendly, they are not so inimical as would naturally be imagined. The rattlesnake seems never to be wanton; it simply defends itself from danger, or procures its food by means of its terrible fangs. This food occasionally consists of the young of the prairie dog, but probably very seldom of the full grown animal or of the owl. Small animals do not usually show much fear of these reptiles when thrown together with them, and the prairie dog will unconcernedly pass them by and enter his burrow as they lie basking in the sun at its very entrance.

Prairie dogs readily become accustomed to the haunts of man, and their villages are often found on the outskirts of populous towns. They prefer, as locations for their villages, gently sloping lands skirting valleys, yet they are often found in the tops of the highest divides, and far down near the streams, though always avoiding rocky, marshy, or even moist grounds.

REMAINS OF GIGANTIC ANTE-DILUVIANS.

The accompanying illustration represents some very important discoveries of gigantic fossils, which were unearthed last year in the Rocky Mountains, near Morrison, Bear Creek, Colorado, by the Rev. Arthur Lakes, Professor of Geology at Jarvis Hall, Colorado. The interest of these discoveries lies in the fact that they have been found in strata pronounced by professional geologists to be barren of vertebrate fossils. Some of these remains have been reached by blasting in the hard sandstone, and others have been dug out of a bed of soft clay lying beneath the rock, and these latter

are very perfect and of monstrous size. Thus some twenty-five colossal vertebrae average from 11 to 15 inches in diameter, and one mass of vertebrae, consisting of three vertebrae ossified together, measures nearly 3 feet square. Close by its side, as represented in the sketch, is another long bone, 3 feet 10 inches long and 22 inches at the butt end, possibly a scapula; but by far the most enormous bone is a portion of a femur, or thigh bone, measuring five feet in length, 28 by 12 inches in diameter, and the shaft 14 inches wide by 8 inches thick, weighing 600 lbs. Lying on the ground, like the pillar of some ancient temple, nothing can impress the observer more than this bone with the magni-

**PRAIRIE DOG, RATTLESNAKE, AND OWL.**

dog often rids himself of the nuisance by removing his own quarters to a new burrow.

There are few birds that present a more ludicrous appearance than these same burrowing owls. They spend most of their time during the day standing at the entrance of their dwellings, apparently engaged in deep contemplation. When an intruder makes his appearance, they begin a series of most ridiculous and comical bowings and courtesies, staring all the while with their great solemn eyes; and then, with a cry somewhat like the sound of a watchman's rattle, they fly to a neighboring mound and resume the same air of pensive meditation. In the majority of cases, these owls

**ANTEDILUVIAN REMAINS DISCOVERED IN THE ROCKY MOUNTAINS.**

tude of the animal to which it belonged—this being only a portion of a bone which, when complete, is presumed to have been $7\frac{1}{2}$ to 8 feet long, and formed part of a leg fully 12 feet in length. These remains have been pronounced by Professor Marsh of Yale College to belong to the cretaceous period, and to be those of a new and gigantic species of *Dinosaur*—the largest ever discovered, and the largest known land animal; he names it *Titanosaurus montanus*, and estimates the creature, when alive, to have been fully sixty feet long, and when standing erect on its hind legs, after the custom of *Dinosaurs*, to feed on the foliage of the mountain forests, to have been eighty-five feet high.

With the *Titanosaurus* were found other *Dinosaurs*, one not larger than a cat (*Nanosaurus*), also the remains of a turtle, an almost perfect crocodile's head, with teeth, and several procœlian vertebræ. Of these Professor Marsh says, in his address before the American Association, at Nashville, Tenn.: "The beds of the Rocky Mountain Wealden have just provided us with a genuine 'missing link'—a saurian *Diplosaurus*, with essentially the skull and teeth of a modern crocodile, and the vertebræ of its predecessor from the Trias. This peculiar reptile clearly represents an important stage in the progressive series, and evidently one soon after the separation of the crocodile branch from the main stem."

The sketch (made on the spot by a correspondent of the *London Graphic*) on page 875 represents the bones after they had been freed from their rocky surroundings, before being packed and forwarded to the Yale Museum. These excavations have been carried on by Professor Lakes since March of last year, with all the eager interest of a Layard disinterring Nineveh, or of a Schliemann exhuming Troy.

COOKING BY SOLAR HEAT.

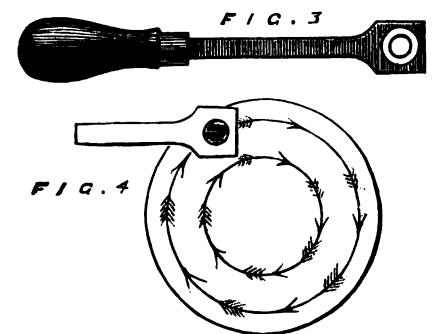
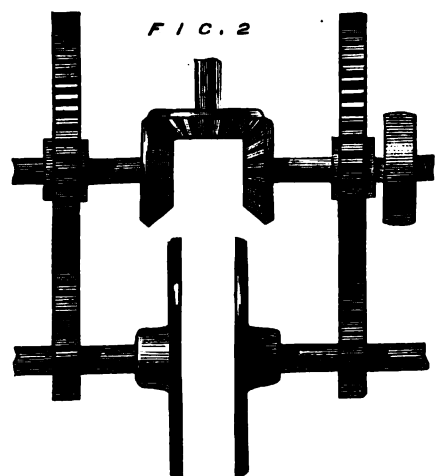
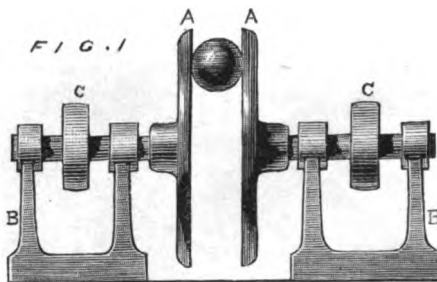
To the Editor of the *Scientific American*:

I send you a short account of my experiments, made in Bombay, on the utilization of solar heat for cooking. The accompanying engraving will give an idea of the principle of the cooking apparatus. It consists of a conical reflector, A, made of wood and lined with common silvered sheet glass. Inside there is placed a copper cylindrical vessel, B, covered by a glass cover, C. The cooking vessel is raised about four inches from the bottom, and the glass cover is five inches longer than the vessel, and two inches wider, which leaves an interval of four inches of hot air under the boiler and one inch all round and at the top. The wedge under the apparatus is to keep it inclined, so that the rays of the sun may fall perpendicularly on the boiler. Glass being diathermanous to the direct or reflected rays of the sun, and non-diathermanous to obscure heat, the rays penetrate the glass, and, striking on the vessel, become transformed into obscure heat, when they are retained by the glass. The glass cover over the boiler is made octagonal, because, in that form, common window glass can be used. Of course a glass dome, such as is used for covering clocks or statuettes, would be better, and, equally, of course, a copper reflector electroplated with silver would be better than my reflector; but both of these articles are made octagonal in order that cheap material may be employed. The position of the apparatus requires to be changed about every half hour, to face the sun in its apparent course from east to west. The rations of seven soldiers, consisting of meat and vegetables, are thoroughly cooked by it in two hours, in January, the coldest month of the year in Bombay, and the men declare the food to be cooked much better than in the ordinary manner. Several people in Bombay and in the Deccan have tried it, and always with success. If the steam be retained the dish is a stew or a boil; if it be allowed to escape the food is baked. The reflector is two feet four inches in diameter. The intensity of the heat is increased by increasing the diameter of the reflector. One advantage of this apparatus is that the food will keep hot for a long time after the apparatus has been withdrawn from the solar rays. I withdrew it at 4 P. M., brought it into a room, and threw a railway rug over it. At 8 P. M., when it was uncovered, the metal vessel was too hot to be handled by the bare hand. I have a letter from a Surgeon General in the service, which informs me that he cooked a leg of mutton in it, and that it "kept hot for four hours" after having been removed from the air.

I am getting one made six feet in diameter, which will differ from that represented in the engraving by consisting of fourteen flat glasses instead of eight, and by having an angle of 45° until it is on a level with the middle of the vessel, and thence upward an angle of about 60° , by which arrangement the whole of the rays reflected from the silvered glass will fall on the lower half. Besides cooking food, I am making a series of experiments for heating steam boilers by concentrating the rays of the sun upon them.

For this purpose I use a combination of flat mirrors, of common sheet glass, silvered, fixed in rectangular frames so as to concentrate the solar rays to a focus at a distance of 20 feet. The focus is about 2 feet in diameter. The plan is on the same principle as that of Archimedes, by which he burned the Roman fleet, which, under Marcellus, was blockading Syracuse—the same plan as that suggested by Anthemius of Tralles in the problems by which he proved the exploit of

Archimedes to be possible; and as that suggested by Kircher, and in 1747 adopted by Buffon. With 72 pieces of silvered sheet glass, each $15 \times 10\frac{1}{2}$ inches, at midday, in the month of May, a focus was formed, at a distance of 20 feet, of a temperature above $1,088^\circ$ Fah. I arrived at that estimate as follows: 18 glasses raised the mercury in the thermometer to 360° ; 36 glasses raised it to over 644° , when the mercury entered into ebullition, and consequently any further rise could not be registered. The ebullition of the mercury was very violent. Placing the temperature produced by the 36



LATHE FOR TURNING SPHERES.

glasses at 644° , the boiling point of mercury, and deducting 100° as the initial temperature of the atmosphere (the thermometer was in the shade), there remain 544° produced by 36 glasses. The focus from the remaining 36 glasses was then added, making 72 glasses; and I think it may be inferred that the temperature was then above $1,088^\circ$. Every kind of wood placed in this focus was instantly ignited, without being, as in Buffon's experiment, previously smeared with tar and shreds of wool. A solid cylinder of water, 18×8 inches, contained in a vertical copper vessel, provided with a steam pipe, was then placed in the focus, and it boiled in

4 feet. The focus will be about 2 feet in diameter, and (according to the calculation made on the basis of the results of the experiment with 72 glasses) the temperature will be over $7,616^\circ$ Fah. The objects of that experiment will be to ascertain how soon after sunrise the water can be provoked to boil, the pressure that can be obtained in a given period, and the quantity of water that can be vaporized in a given time. Other experiments will be made, such as exposing different metals to the focus, etc. The boiler that will be used on that occasion is a vertical boiler, 2 feet 7 inches high and 16 inches in diameter, with an annular cylinder of water 3 inches in diameter up to half its height. It is made of beaten copper, $\frac{1}{4}$ inch thick, which will stand any pressure that can be produced in a boiler of those dimensions. It is provided with a steam pipe, a steam gauge, and a safety valve, and with no other fittings. The 20 frames will stand in two rows of 10 each, the second row on a platform 6 feet 6 inches high, forming a segment of a circle of 40 feet in diameter.

As there is no limit whatever to the number of these mirrors that can be used at once, there is none to the intensity of heat that can be produced, and consequently no limit to the force of the steam that can be generated. The cost of the reflecting material is next to nothing, and it is almost everlasting. There is no mechanical difficulty in keeping the focus on the boiler from soon after sunrise to a little before sunset.

I am aware of the force of the objection that the solar rays are sometimes intercepted by clouds, even in India; but as an auxiliary to the ordinary boilers, I believe that solar heat could be used so as to save at least 25 per cent of coal throughout the year by my plan. As coal in the seaports of India is never under 30 shillings per ton, and double that rate in the interior, such a saving would be exceedingly important. There are many other purposes to which it could be applied besides driving steam machinery or cooking food, such as distilling and rectifying spirits, etc. At Aden, for example, the sun always shines, and potable water is only obtained by distilling it from salt water.

I shall be very glad to have any expression from your readers upon the subject, especially upon the result of the experiment that I have described.

W. ADAMS.

Bombay, India.

PRODUCING ACCURATE SPHERES.

An ingenious method of grinding perfect spheres was first proposed by the late Mr. H. Guy. It is especially applicable to hard materials, such as steel, glass, etc. Its principle is based on the fact that the section of a true sphere at any part is always a circle. In its application to the tools shown in the accompanying illustrations, the balls are first turned in the ordinary manner as correctly as possible, and a trifle larger than the required finished size. Mr. Guy's apparatus consists of two beechwood disks (A, Fig. 1), face to face, and attached to two lathe spindles and headstocks, B. The distance of these disks from each other is capable of nice adjustment by a screw or other suitable arrangement. On the spindles may be keyed two equal pulleys, C, over which a band passes from the power, crossed on one and open on the other; thus the two disks are driven in opposite directions with equal velocities. For a sphere of 1 in. diameter, Mr. Guy recommended disks of 10 in. diameter, and making about 400 revolutions per minute.

Mr. Wm. Granger, in a communication to the *English Mechanic*, proposes a modification of the apparatus, shown in Fig. 2, in which a more uniform motion is obtained by using small toothed wheels, and three bevel wheels to reverse the direction. The grinder is shown in Fig. 3, and is

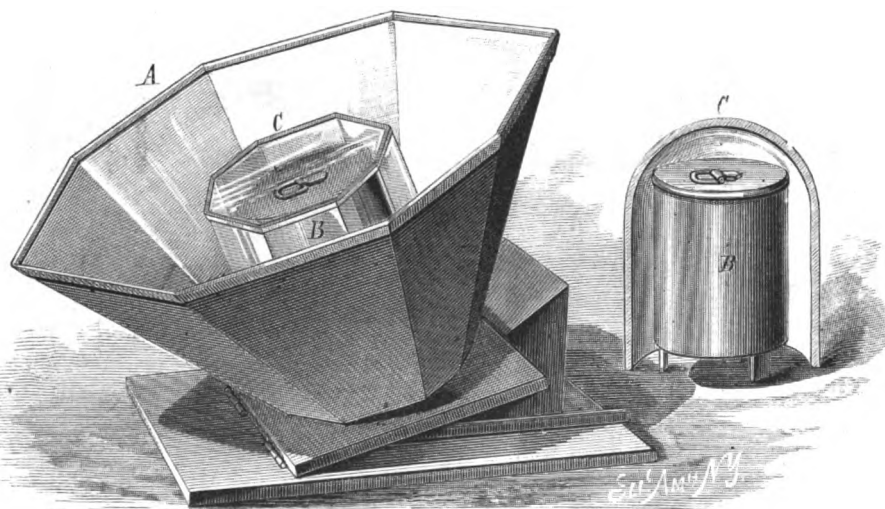
made of a piece of flat copper or brass with a conical hole through it, large enough to allow about one fourth of the sphere to project on the small side. The thickness of the grinder may be about $\frac{1}{4}$ in. diameter of the spheres, and the hole should be reamed to an angle of about 25° . It is important that the amount of bearing surface in the grinder should be narrow; about 1-16 inch for a 1 inch sphere is quite sufficient.

The rough sphere and the grinder are placed between the revolving disks, the former being tightly gripped between them; oil and emery powder are supplied to the grinder, and holding the latter in the hand, the ball should be made to traverse uniformly all around the disks, as in Fig. 4. Care should be taken to prevent the ball from stopping between the disks, as this would grind facets upon it. As the operation proceeds, finer emery must be used, and the sphere tried from time to time in a ring gauge of the required size. For precise work the finishing is done

with disks covered with buff leather, and crocus is used instead of emery. The grinders must frequently be trued up with the reamer, as they soon wear out of shape.

Portrait of Prof. Henry.

We are indebted to F. Gutekunst, the well-known photographer, 712 Arch Street, Philadelphia, Pa., for a fine photographic likeness of the late Professor Joseph Henry. It is one of the last, and we are not sure but it is the very last one for which this distinguished scientist sat.



ADAMS' SOLAR COOKING APPARATUS.

exactly 20 minutes. The ebullition was exceedingly violent. In January last I made another experiment with 198 glasses, each $15 \times 10\frac{1}{2}$ inches, fixed in 10 rectangular frames. A copper boiler containing 9 gallons of cold water was placed in the focus at 9:25 A. M. It commenced to boil in exactly 30 minutes. It was allowed to boil for exactly 1 hour, and at 10:55 the focus was turned off, when $3\frac{3}{4}$ gallons of water were found to have been evaporated.

My next experiment will be made with about 500 of these glasses, fixed in 20 rectangular frames, each 6 feet by about

ORGANOGRAPHY, OR VEGETABLE ANATOMY.

Muscles are the chief instruments of voluntary motion in men and animals, and popular comprehension has hardly recognized, as yet, the fact of plant organization being an exact analogue to that of human beings. This has been generally supposed to be merely a speculation or theory among the learned or imaginative, and plants considered as rooted or fixed to one place, while the question of movement has been overlooked simply because plants do not rove about. It cannot be denied that the power to move may be exercised in different modes and directions, while the instruments may be essentially identical. In the human body movement is perpetual, and by no means limited to the act of walking. Life itself is movement, and the contrary, in figurative speech, is always understood to be an equivalent for death.

The flux and reflux of currents in the growth and development of plant life are continual, and readily admitted by the most superficial observer; but the instruments or organs by which spontaneous movements are made are not ordinarily admitted as even existing. Muscular contraction is to be found in those fibers of the footstalks of leaves, which act in closing their upper surfaces together, or bending them downward; within the claws of petals, and divisions of the calyx, when exerted for the purpose of opening or closing the corollas or calyxes of the florescence. They act also as resistants to external irritation or internal sensations of discomfort in the plant individual, making efforts to prevent or remove sensations which annoy, or to encourage those which are necessary and agreeable. They act under the stimulus of light, turning the upper side of the leaf to the point most favorable for receiving that stimulus. The Abbé Tessier ("Hist. de l'Académie Royal, ann. 1783") exposed a variety of plants, in a cavern, to different quantities of light, and demonstrated satisfactorily that the contraction or elongation of muscular action in plants, or, in other words, their elasticity, was sensibly affected by the presence or absence of light.

Instances of muscular dilatation and contraction abound, and to the observant eye are very evident. To quote from an Italian writer: "If the top of the floret (chondrilla) be touched (which has five stamens surrounding one pistil), all the filaments which support the cylindrical anther will contract themselves, and, by raising or depressing the anther, the whole pollen will be collected on the stigma; and if one filament be touched after it is separated from the floret, it will be found to contract like the muscular fibers of animal bodies."

Plants are known to change the direction of their roots or trunks, as, for instance, where a plant has been inverted intentionally, or placed root uppermost, the root makes an effort to curve downward, and the stem upward, until it regains its natural and proper direction. Acted upon by the air, sun, and light, the muscles direct the upward course of the stems; and acted upon by the moist warm vapors in the ground, they also determine the direction of the roots. While in some species the muscles are robust and powerful, in others they are extremely delicate and minute, but none the less fitted to be instruments for fulfilling the will of the individual plant, the same as the muscles of a man obey the mandates of his active brain.

A plant named *Upata* or *Sanar* is found in Senegal, with roots which rise vertically a foot above the surface of the earth. With the aid of their muscular fibers plants are enabled to forsake a poor soil and reach a better one. They frequently succeed in reaching to newly formed ditches and canals, where they can obtain a more abundant supply of moisture. Roots and branches are known to surmount almost insuperable obstacles in order to gain their end, that is, to supply their necessities. A branch has been known to leave its normal direction parallel to the soil, and to overtop an obstruction, with the evident purpose of attaining a more favorable exposure to the sun, air, and light. Roots penetrate into hard soils, through stone walls, and even into rocks by bursting them. By means of muscular elasticity numerous flowers leave their perpendicular direction, and, with the purpose of exposing their faces to the sun, follow his diurnal course by looking towards the east in the morning, the south at noon, and the west at evening. Moisture and dryness are both necessary conditions for the action of muscular fiber. The existence of these fibers was incontrovertibly established by the observations of La Hiré, Hales, and Bonnet.

Change of direction is conspicuous in the altered aspect of plants at night, and under excess of moisture, particularly evident in compound or pinnated leaves. The winged leaves of the leguminous tribe, acted upon by the heat of the sun, rise vertically and form a right angle with the common footstalk, the lobes or lesser leaves clinging together by their upper surface. Simple leaves, as in Indian mallow (*Urena*), when exposed to the sun, become concave. Winged leaves, in a close, moist, and cloudy atmosphere, may be found

extended along the common footstalk; and after the sun sets, they hang vertically downward, closed together by the lower surface, like the leaves of a book. If there is an odd lobe at the extremity, it folds upon itself until it reaches the first pair of leaves in its neighborhood. The simple leaves of bastard and feverfew are good examples. In trefoil, lucerne, and lotus they unite by their extremities, and form a cavity of protection from the chill of the night season. According to M. Duhamel, this muscular motion is, in sensitive



VENUS'S FLY TRAP.

plants, evinced in the two forms of natural and artificial; warm vapors causing the one, and external agencies, such as touching or shaking, causing the other. The muscular motion of the sensitive plants is laid open to our inspection, and is an instance of extreme contractile force. At the lightest touch of the hand they move, close their leaves, and bend their branches, until a sympathetic agitation extends throughout a whole savanna; a sight which charmed and astonished the Spaniards who penetrated the American Isthmus in 1548, who gave them the expressive appellation of *dormideras*.

The sensitive plant of Senegal, called by the negroes *guerikar*, or "good day," has been frequently described. When it is touched, or even bowed to, it inclines

its stem and turns its leaves as though in polite response to a salutation. The *Dionaea muscipula* (Venus's fly trap) is another familiar instance, to be found in marshy soils in North America. The leaves are massed in rosettes around the floral stem, and spread out upon the soil. These have at their extremities a sort of reddish appendage, hollowed into two large lobes, attached to the main leaf by the mid vein only. The edges of these foliated lobes are garnished with hairs, and their surface bristles with little points, constantly covered with a viscous liquor which attracts insects, particularly flies, which are dissolved by matter secreted in the plant, or, as we might with propriety suggest, digested, and affording nutrition to the plant. As the fly struggles, the leaves contract, and the insect is either suffocated or bled to death upon the bristling points of the leaf.

The true sensitive plants of South America are described by M. de Martius in his "Travels in Brazil," as closing their leaves by an agitated muscular movement when even a horse galloped over distant ground, and equally startled by the approaching step of a man. The animation of an extended group of these sensitives in that tropical climate must carry with it to the mind of the beholder a curious sensation of awakened conviction in regard to the intensity of animation, which is less prominent, though, as we believe, no less actual in the vegetable lives of colder climates. The burning sun and luxuriant growths of Brazil, for instance, reveal a movement and an expression, which, seen for the first time, convey a freshness of conception which equals an added power of vision, and is not readily forgotten, but ever after colors all conceptions in regard to vegetable beings, as organized harmoniously, with complete organs for the execution of equally complete functions.

R. C. K.

MEXICAN FLORA.

Our engraving shows some of the prominent types of the flora of the hotter and drier portions of Mexico. At the left is an agave, a genus of the order *Amaryllidaceae*, or American aloes, the common species of which is known in Mexico as *mescal*. From its sap, obtained by incisions in the stem, a fermented liquor, called *pulque*, is made, which, when distilled, forms the *vino mescal*, or common cactus brandy. It is a popular error that the plants or trees belonging to this genus require a century to arrive at maturity, when the flower is put forth, to remain dormant, so far as efflorescence is concerned, for another full century. In hot climates, otherwise favorable to development, maturity is reached sometimes in ten years; but in colder countries a much longer period is required, thus affording some justification for the popular belief.

Several varieties of cactus are also shown in the engraving. In the foreground are specimens of the *C. opuntia*, or prickly pear, and of the *C. melocactus*, the great melon thistle or "Turk's cap," as it is sometimes called, one of the most remarkable members of the family. The large cactus in the background is the *C. cochinitifer*, which forms the chief nourishment of the cochineal insect.

New Inventions.

Mr. N. Overfield, of Rockaway Beach, N. Y., has contrived a Portable Bathing House made of canvas stretched on a frame so constructed as to be readily taken down and adjusted in compact form for removal or storage. The arrangement for ventilation is efficient.

Mr. H. D. Cress, of Cromwell, Ind., has invented a simple Draught Equalizer, consisting of a draught bar, to the ends of which the outer traces are hooked, the inner traces connecting with a chain which passes over a pulley carried by a plate secured to the middle of the draught bar. The whole is securely braced.

Mr. A. Dittrich, of St. Luke's, England, has patented a spring-acted Umbrella Tip Cup, capable of being readily applied to the umbrella stick, and without requiring detachment of any portion of the frame.

An improved Heating Stove, invented by Mr. F. J. Gould, of Sidney, Ohio, is of the double magazine, base-burning type, and is intended for burning soft coal. In the old styles of double magazine stoves the gas generated in the inner magazine had no other escape but the top of the stove, so as to vitiate the air; this is prevented by an arrangement of draught holes of the outer magazine. Other advantages are claimed.

Mr. G. W. Gomber, of Hazleton, Pa., has patented an improved Bottle Stopper, which is operated on the same general plan as the De Quillfeldt stopper, but made compound, with a different hanging of the eccentric lever, and with new details intended to give increased durability.

A convenient Clasp for Pocket Books, patented by Mr. Louis Prahar, of New York city, is so constructed that it may be put together after being plated, without danger of marring the plating, and which, it is claimed, cannot be detached accidentally.



AGAVE, CACTUS, AND MELOCACTUS.

Mr. N. Fox, of Savannah, Ga., has patented an improved Bottle Stopper, especially for effervescent liquids, which permits the bottle to be closed before removal from the filling machine. The principal parts are a collar, secured to the bottle neck, a cap which screws down upon the collar, operating a ball valve, and a suitable nozzle.

Mr. G. W. Everett, of New York city, has patented a Skirt Holder for drygoods stores, etc., which may be conveniently folded into a narrow space for being packed in a trunk or otherwise stored away.

An improved Clothes Pin, patented by Messrs. H. L. Clark and A. B. Smith, of Chester, N. Y., is formed by the combination, with a straight-shanked hook having a thumb piece and stop, of a spiral spring and follower, the latter having two fingers which engage with the hook.

An improved Child's Carriage, invented by Mr. C. Gillis, of Brooklyn, N. Y., has a flexible body, like a hammock, and the frame is so arranged as to fold into a small compass for carrying upstairs, or may be readily taken to pieces for transportation.

A new Harness Pad, recently patented, is claimed to rest easily upon the horse's back and not press upon the spine. The tree is a flat bar of wrought iron having end loops for receiving the trace-supporting traps, and having ears on each edge for receiving the pad-fastening screws; and the pads are wooden blocks covered with several thicknesses of cloth or felt and leather. The inventor is Mr. L. W. Vandenburg, of Honesdale, Pa.

Mr. Henry Holcomb, of Painesville, Ohio, has invented an improved Hot Air Furnace, which is provided with automatic means for regulating the admission of cold air into the fire chamber, and which embodies a number of novel details.

An amusing Mechanical Toy, recently patented, may be said to convey a moral. It is called "the careless engineer," and illustrates by a harmless clockwork explosion the danger attending an engineer's carelessness. It may also be set so as to run without accident, showing the safety which results from proper care. This is the idea of Mr. Stacy Potts, of Philadelphia, Pa.

An improved Knife Scourer, patented by Mr. N. A. Wierman, of Bendersville, Pa., is claimed to be made much more durable than is usual by making the scouring rubbers detachable, so as to present a fresh face from time to time, and by applying the pressure at the middle of the rubbers, at the point where the most wear occurs, so as to hold them to their work even when considerably worn.

A new Fire Escape, patented by Messrs. John Swank and Arnold Jehnke, of Denver, Colo., is of the class in which the downward motion of the person is checked by means of a friction clutch attached to the drum carrying the rope by which the descent is made. It has, in addition to a spring acted clutch, a further safeguard in the shape of a brake operated by a nut, to be used in case the clutch proves insufficient.

An improved Rocking Chair of the class having a stationary base and spring connected rocking seat, which has lately become so popular, has been invented by Mr. M. Schrenkeisen, of New York city. The interposition of rubber blocks prevents jar as the chair reaches the end of its forward or backward movement, and there are other improvements.

Mr. E. T. Rogers, of New York city, has invented a Filter intended for the feed water of steam engine boilers and similar uses. It has a vertical breakwater plate and one or more vertical screens at the inlet end, and similar vertical screens at the outlet end, with a central charcoal chamber, and under it a sediment receptacle.

Mr. John Conrath, of Salamanca, N. Y., has patented an apparatus for Drying and Stretching Curtains, arranged to keep the curtain under tension by its own weight while drying, and capable of being compactly folded when not in use.

A Lock for Stovepipe Joints, designed to keep the lengths from coming apart and the line of pipe from sagging, has been patented by Mr. J. W. Woolsey, of Henderson, Minn. A metallic strip riveted to one length passes through a slit in a corresponding strip attached to the other length, and is bent upon itself, forming a secure tie.

Messrs. N. N. Sprecher and I. B. Keller, of Reading, Pa., have patented an improvement in Shirt Scales, which is claimed to provide a convenient and reliable rule for graduating slopes required between different diameters of neck measurement in all sizes and proportions.

Mr. F. J. Grotevent, of Reading, Pa., has patented a convenient Mailing Package for transporting small quantities of powdered substances as samples. It is a box having a hinged lid at each end, and contained by a paper wrapper and a cloth wrapper, both of which are wrapped permanently around the box, folded over upon the lids at the ends of the box, and held in place by cord, which may be easily unfastened.

An improved Dumping Wagon, the invention of Mr. J. H. Nelson, of Wayne, Wis., has a box made in four sections, either of which may be emptied independently. By this construction the load may be discharged in four separate heaps.

Manufacture of Chloride of Lime.

A new process for the expeditious manufacture of dry chloride of lime has been invented by Mr. E. Maletta, of Paris, which consists in the employment of mechanical means for stirring, agitating, or mixing the powdered lime and the chloride of lime as fast as it is formed, in such a manner as to expose all the molecules of these substances in succession to the continuous action of the gaseous chlorine,

which is introduced under favorable conditions for combining with the lime, and is rapidly absorbed by the latter. In order to insure regularity, it has been found necessary to couple at least two apparatus together, so as to admit of the chlorine being directed into either, as required. The process is very rapid, and is carried out with great facility, and without any waste of chlorine. The progress of the operation may be constantly watched by persons near the apparatus, which emits no injurious odors. The apparatus is cheap in construction, and occupies but small space. The manufacture may be regulated at will, as examples of absolute homogeneity (as may be ascertained by testing) may be taken at any time during the operation. As the chloride of lime manufactured in this manner is homogeneous in every part, it is not liable to become decomposed, as is the case with chlorides manufactured in layers, more or less deep, and in a state of rest, and a source of considerable loss is thereby avoided in the manufacture of this product, which is liable to deterioration from the influence of climate and other influences resulting from its composition.

Natural History Notes.

Leaf Veins of Poison Hemlock.—Some interesting remarks on the leaf of the poison hemlock (*Conium maculatum*) formed the substance of a paper recently read before the Linnæan Society by Mr. J. Gorham. From his observations it was shown that in a piece of the leaf, one third of an inch long by one fifth wide, the veinlets were arranged exactly in the same way as the venation of the entire leaf. This was also found to occur in the other umbelliferous plants that were examined, so that it was possible to detect and recognize each from the merest fragment. This is something like describing an animal from a bone. These facts open a new field to the student of botany, besides promising to be of valuable service in medico-legal investigation. The relation of the venation of leaves to the branches of a tree may yield more interesting facts on investigation.

Habits of the Fur Bearing Seal.—At a recent meeting of the Linnæan Society there were exhibited mounted specimens of the fur bearing seal of the Pacific, male, female, and young. Mention was made of the "rookeries" of these animals, containing over three million seals in a compact area. Like old Turks, a male dominates over a harem of a dozen or fifteen females, which he guards with jealous care, for two months or more never stirring from the spot, and meantime fights terrific battles for its maintenance. A neutral zone exists to the rear of the breeding grounds, where the enforced bachelors and adolescent young of both sexes repair. These come and go continuously, passing to and fro through free lanes of passage. Others of these creatures delight in dashing among the breakers on the surf, or frolic and play in droves on the sand and grassy dunes adjoining the more rocky ground of the "rookery." In preparing the skins of these seals for commerce, the under side is shaved in such a manner that the roots of the long, coarse hairs are cut loose and the hairs set free, so that nothing is retained but their fine fur.

A Rare Bird at Central Park.—There is at present on exhibition at the Central Park menagerie, for a short time only, while in transit for Europe, a very rare specimen of a bird belonging to the family *Megapodidae* (so named because of their large feet). This is the first specimen ever brought alive to this country, and will be the first living example ever seen in Europe, should it arrive there safely. It is a native of one of the East Indies—Nina-Fou or Proby Island, which is situated about half way between the Feejee and Samoan Islands. The bird is of a uniform blackish-brown color, cheeks and upper part of neck vermilion red, slightly feathered with small black plumes, bill bright yellow, tarsi and toes pale yellow, claws black; length from bill to end of tail about 14 inches. There are about twenty species belonging to this family of megapods. They are found chiefly in the tropics, and inhabit dense forests and swamps, generally in the vicinity of the sea beach. These birds are remarkable for the extraordinary contrivances resorted to by them to obtain the artificial heat necessary to hatch their eggs. For this purpose some of them form mounds, and are hence called "mound builders." These mounds, which sometimes reach fourteen feet in height, with a circumference of 150 feet, are composed partly of vegetable matter, which the birds bring by small quantities at a time in their large feet. In the middle of these mounds, at various depths (from 18 inches to several feet) the females deposit their eggs, some in the form of a circle, while others of a different species place them irregularly. When the eggs are all deposited, the center is entirely covered in, and the mound raised several feet in the form of a cone. The heat produced by the fermentation of the vegetable matter is then retained within the mass, and brings the eggs to maturity. The birds are usually engaged in laying their eggs during a period of from two to three months. The Celebean megapod has a different method of hatching its eggs: it places them in a hole which it has dug out of a rotten stump; then, covering them up with vegetable matter, leaves them. Again, other members of the family burrow obliquely into the sand along the seashore to a depth of three or four feet, deposit their eggs at the bottom, then cover up the mouth of the hole, and try to conceal their foot-marks leading thereto by scattering the sand about. The habits of the Central Park species (*Megapodius pritchardii*) differ from those of the others in some respects. It scoops out its nest in the side of a little lake in the center of the island, between one and two feet in depth, laying about forty eggs in the months of Sep-

tember and October. The exact period of incubation is unknown. The most remarkable thing about these birds is that, after all the trouble and care taken for the preservation of their eggs, they should be so utterly indifferent to the fate of their young, leaving them to scratch their way out of whatever position the eggs were placed in, and to take care of themselves afterwards.

The American Oyster.—It is a well known fact that the edible oyster (*Ostrea edulis*) attains its full growth and proper flavor only in the waters of the American coast; and that its representative in Great Britain, owing perhaps to some trouble in its "environments," has dwindled down to a minute coppery-flavored bivalve, which affords to the evolutionist a melancholy example of "reversion," and to the American gastronome an object of aversion. It is no wonder, then, that when one of our American oysters is seen for the first time by an inhabitant of the British Isles, it should call forth expressions of great surprise. An English gentleman who has been indulging in some of our exported "Blue Points," writes to the "Notes and Queries" column of a recent number of *Land and Water*, asking for information in regard to these "delicious mollusks." He says:

"As an old correspondent, I want to know, in common with many of your readers, who have asked me the question, what are Blue Point oysters? Now, perhaps my friend Mr. Buckland, who has done so much for and written so well on these delicious mollusks, will enlighten us. Tempted by the advertisement in *Land and Water*, I sent to the offices of the New Direct Supply and Trading Association, Cannon street, for a bag of fifty for only 4s., including a knife. I found them excellent, notwithstanding the extraordinary shape of some of the shells, which I send with this. One of them you will see is like the Irishman's gun, which, being bent, he said was made to shoot around the corners; but the contents of this were very fine, large, and plump, as indeed all were, more or less; the contents of the smallest shells were frequently larger than those contained in the more pretentious. I wish to direct your attention to the large black spot in the middle of the flat shells of all of them; they are now slightly fading, but when first opened were quite black. I should like to know if this color has anything to do with the flavor, for I found the blue points so good that I have had three, and am now going to order another basket. They are reported to come from America. When Mr. Buckland returns from his official tour in Cornwall, perhaps he will tell us something about them, or Major Iles Home, the obliging manager of the Stores, will enlighten us, saying how long the season lasts for eating them."

An Imprisoned Owl.—The Lancaster (Pa.) *Examiner* says: "The owner of a large farm, not far from Lancaster, had an opportunity a few days ago of witnessing how an interloper is punished by the martin species of birds. A pair of martins had taken possession of a small box, and were building their nest. One day, while they were absent, a screech owl took possession of the box, and when the martins came home at night would not allow them to enter. The smaller birds were nonplussed for a while, and in a short time flew away, seemingly giving up the fight. But if the owl was of this opinion he was sadly mistaken, for in a short time the little ones returned, bringing with them a whole army of their companions, who immediately set to work, and, procuring mud, plastered the entrance to the box shut. They then all flew away. In a few days the box was examined and the owl was found dead."

Solid-hoofed Pigs.—Dr. Coues states that a breed of solid-hoofed pigs has apparently been established in Texas. The terminal phalanges of the toes are united to form a single broad phalanx; above this, however, the other two phalanges remain perfectly distinct. The hoof is perfectly solid, and on its sole there is a broad angular elevation of horny substance, which is curiously like the frog of the horse's hoof. The breed is so firmly established that no tendency to revert to the original and normal form is observable. It is further stated that, in the cross of a solid-hoofed boar with a sow of the ordinary type, a majority of the litter have the peculiarity of the male parent.

African Explorations.

The United States Consul at St. Paul de Loando reports to the Department of State that the German exploring expedition sent out under the leadership of Herr Otto Schmitt by the Geographical Society of Berlin, and which recently left Loando for the purpose of making accurate surveys east of Quango and south of the Congo, had safely reached Melange, about 200 miles south of Loando, where heavy rains had delayed them. When these rains are over, the expedition will again resume its march. Much valuable work had already been accomplished, and a number of maps of actual surveys had been made, of which copies will be sent to our government.

In this connection it may be stated that the United States Commercial Agent at Gaboon informs the Department of State that more missionaries are following in the path of Stanley's discoveries, two having recently spent a few days at Gaboon en route for the Congo, who had been sent out by philanthropic merchants at London and Liverpool, to ascend the south bank of the river to a point above the first rapids, where they are to establish an industrial Christian mission. This and similar enterprises, the agent thinks, will pave the way for the extension of commerce and steam navigation upon the vast interior rivers of Ethiopia and the development of her valuable resources.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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NEW BOOKS AND PUBLICATIONS.

PRINCIPLES OF MACHINE CONSTRUCTION. By Edward Tompkins. With volume of Plates. G. P. Putnam's Sons, Publishers, 183 Fifth Avenue, New York.

This work belongs to Putnam's Advanced Science series. It is an exceedingly clear, well arranged and well edited treatise, simple enough for the student of mechanical engineering at the outset, and at the same time it will prove a useful manual of reference to the practicing engineer. We can commend the book as one which embodies a great deal of information which too often by the free use of the higher mathematics is made unnecessarily obscure. No extensive knowledge on the part of the reader is here presupposed. The author begins with simple drawing apparatus, and devotes his initial chapter to the rudiments of draughting. He then advances through various geometrical constructions, development of surfaces, etc., and finally in the chapter on "Motion" enters upon the application of the principles laid down. Elementary combinations of mechanism, a discussion of materials, modes of construction, a good clear exposition of the difficult subject of gearing, and lastly the practical building of machine tools, make up the rest of a volume which impresses us as excellent from beginning to end.

PINE PLANTATIONS ON THE SAND WASTES OF FRANCE. By John Croumbie Brown, LL.D. Edinburgh: Oliver & Boyd, Publishers.

Dr. Brown has published a number of valuable work on silviculture, which contain strong arguments against the destruction of forests and in favor of reclaiming waste lands by tree planting. The present work relates mainly to the attempts at arresting and utilizing the sand drifts on the waste regions in France by the plantation of the pine and other trees or grass, the suitability of which is indicated by the nature of the soil and atmospheric conditions.

A MANUAL OF INDUSTRIAL CHEMISTRY. Edited by B. H. Paul, Ph.D. New York: John Wiley & Sons, 15 Astor Place. Price \$10.

This work is based upon a translation of Stohmann and Engler's German edition of Payen's "Précis de Chimie Industrielle." It is copiously illustrated, and the editor has added some chapters on the chemistry of the metals. As a manual for general reference it will probably serve instead of larger and more costly works, as it contains much useful information in condensed form.

PROTECTION AND REVENUE IN 1877. Published by G. P. Putnam's Sons, 183 Fifth Avenue, New York.

This is a lecture delivered before the New York Free Trade Club by Professor Sumner of Yale College. It adds many cogent arguments to one side of a controversy in which it is not the province of this journal to participate.

Notes & Queries

(1) G. W. S. asks: Can any saving be made in battery material of Callaud cells by breaking circuit when not needed for use? A. If the circuit remains open any length of time the blue (copper) solution reaches the zinc; soluble zinc sulphate is then formed and the copper deposited on the zinc. The Smee or Leclanché cell is better suited for open circuit lines.

(2) C. B. P. asks: 1. What is the title of M. Peclet's work, so often quoted in Rankine's treatise on the steam engine? A. "Traité de Chaleur," par M. Peclet, Paris. 2. Who are the standard authorities on locomotive engineering? A. Colburn, Clark, Holley, and Forney are authors of standard treatises on the locomotive. 3. Does an engineer, who makes a specialty of locomotives, require to be well versed in the higher branches of mathematics, such as calculus, trigonometry, or conic sections? A. Some of the most successful builders have been ignorant of the higher analysis, but such knowledge is frequently of great assistance.

(3) O. J. B. asks: Which will transmit more power, a polished cast iron pulley or a rough one? A. A polished pulley.

(4) W. M. J. writes: I wish to build a 16 x 25 foot drying room for green lumber 25 feet from my engine, using the exhaust steam from the engine, which is 25 horse power. It takes all the power to do the work required of it with a free exhaust through a 2½ inch pipe. I am fearful of the back pressure. Will it do to enlarge the pipe ¼ inch, and if so, how many coils of pipe will be necessary? A. You can regulate the back pressure to a considerable degree by using large heating pipes. With 3 inch pipe and 8 or 9 coils, which would probably be sufficient for your purpose, the back pressure ought not to be increased more than from 1½ to 2 lbs. per square inch.

(5) G. & H. ask how to galvanize sheet iron. A. The iron should be cleaned by immersion in an acid bath (sulphuric acid and water, equal parts), and then scrubbed with sand or emery. When clean, it is

to be placed in a bath of melted zinc, covered with sal ammoniac. If desired, it may then be placed in a bath of melted tin, or may be used at once, after receiving the zinc coating.

(6) R. J. B. writes: Occasionally I am in the habit of laying my pen, without cleaning, on the writing desk (which is of mahogany) and by so doing have spotted the desk in many places. What will remove the stains? A. The ink may be removed by the application of strong aqueous solution of oxalic acid or a solution of calcium hypochlorite in acetic acid. Apply wet blotting paper to remove excess of solution, and then a dry blotter. After the wood is dry apply a little boiled oil. The spotting cannot be altogether obliterated.

(7) G. S. C. writes: By using oxalic acid with Prussian blue for laundry purposes, it gives the water a greenish tinge. What can I use that will give the water a purplish tinge or a purplish blue? A. Use potassium ferrocyanide instead of oxalic acid, in proportion of about 3 to 20 of the Berlin blue. See p. 909, SCIENTIFIC AMERICAN SUPPLEMENT, No. 61.

(8) E. B. asks whether spur or bevel wheel gearing is preferable, in cases where either kind can be applied. A. Spur gearing is best.

(9) W. & K. write: We have difficulty with a belt in our office. On which will a leather belt slip least, smooth iron, rough iron, or a turned wood surface? A. Smooth iron. As a general rule the best way to prevent the slipping of belts on smooth faced pulleys, is to increase the area of the friction surface by using pulleys of larger diameter or width of face, and belts of a corresponding size.

(10) J. F. N. asks: Will a tin tube answer as a core upon which to wind an induction coil for electrical purposes; would the tin cause any diminution of the current? A. It is not advisable to use the tin tube for the core; it is better to wind the primary coil directly on a core or bundle of parallel iron wires, covered with one or two layers of clean paper soaked in paraffin.

(11) G. M. W. asks: What volume of steam, at atmospheric pressure, is procurable from the evaporation of a unit volume of water, and what would be the ratio of decrease in the volume of steam under added pressure? A. According to Professor Rankine, whose calculations agree quite well with the experimental investigations of Fairbairn and Tate, the relative volume of steam, compared with that of water, is as follows:

Pressure in Atmospheres.	Relative Volume.
1.....	1646
2.....	850
3.....	580
4.....	440

(12) C. W. M. asks: 1. How can rusty steel tools be made bright? A. Clean them with oiled emery paper. 2. How can a soldering iron be tinned when the tin is off, so that the solder will adhere to the iron? A. Heat the soldering iron, and file the end down to the clear copper, then rub it in resin and solder mixed by the heat of the iron. You may have to file the iron twice.

(13) F. L. M. asks: 1. In what kind of water will most likely be found animalcules for low power microscopes from 90 to 100 diameters? A. Any stagnant water. 2. How can I obtain some "paste eels"? A. Allow flour paste to stand two weeks or more in a moderately warm place, in contact with the air. 3. What power is required to distinguish human from other blood? A. Not less than 500 diameters; one fifth inch objective with B eyepiece. It is questioned by some microscopists whether the distinction is always possible.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. A. J.—It is hornblende.—W. M. B.—The fire clay is not of excellent quality. It is of little value as a pigment. Properly tempered it might serve as material for drain pipes, tiles, common pottery, soft bricks, etc.—J. N., Jr.—The glittering particles in the powder are of mica. Not valuable.—A. B. T.—The sandstone and red jasper contain nothing of value.—J. S., M. D.—We do not consider the pebble of value; it is milky quartz.—C. & R.—The sample of quartz does not appear to be auriferous. The other specimen contains silica, clay (aluminum silicate), lime, magnesia, and a little sodium and iron.—E. A. S.—The samples of native magnesium sulphate received. We should be pleased to have further particulars respecting the deposit.—E. McD.—The samples consist principally of lime carbonate with a little sulphate and a trace of potassa, strontium, and phosphoric acid.—D. E.—It is a fair quality of fire clay.—J. D.—Nos. 1, 2, and 3 are argillaceous limestones. Nos. 4 and 5 contain calcium carbonate with a little baryta and strontia. No. 6 is calcareous clay. No. 7 is clay slate. No. 8 is a variety of hematite. No. 9 is a concretionary formation of calcareous clay. We cannot judge from the specimens of the proximity of coal. No. 1 might be used as a building stone, but is rather soft.—W. J. C.—It is zinc blende—of some value as a source of zinc.—W. J. T.—The curious hair-like substance formed on the coke is similar to the mineral wool now largely made from molten blast furnace slag by the contact with a jet of hot air or steam. In composition it is an iron-lime-alumina silicate, containing a little graphitic carbon. Its formation would require an unusually high temperature in the retort.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects: Singular Locomotive Accident. By W. J. T. The Jury at the Paris Exhibition. Storm and Flood Signals. By A. W. Setting Boilers. By F. B. C. Money. By J. A. Iron Mining and Manufactures. By M. I. H. The Phonograph. Ink Wipers. By C. F. S. Price of Machinery. By J. C. H.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

April 23, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Engine, B. H. Taylor.....	202,888
Engine, D. Turner.....	202,894
Engine condenser, W. J. Allen (r).....	8,188
Engine condenser, J. Absterdam (r).....	8,198
Envelope, O. P. Hatfield.....	202,816
Fabrics, machine for cutting, A. Warth.....	202,900
Faucet, bung, S. T. Moore.....	202,855
Felted process, Flagg & Jackson.....	202,805
Fence, W. M. Landreth.....	202,836
Fence, C. H. Phelps.....	202,782
Fence, N. Westcott.....	202,805
Fence, W. B. White.....	202,696
Fence, H. & J. Harrington.....	202,723
Fence post, E. D. Roseman.....	202,870
Fiber, machine for making, L. P. Summers.....	202,766
Fiber, treatment of waste, J. Wilkins.....	202,910
File, bill, T. Lees.....	202,782
Filtering apparatus, A. Van Haagen (r).....	8,192
Fire alarm, signal box, R. N. Tooker.....	202,801
Fire arm, W. H. Bliss.....	202,627
Fire arm, L. Ybarra.....	202,915
Fire escape, F. Detmer.....	202,708
Fire escape, Swank & Jehnke.....	202,767
Fire front, J. A. Ewing.....	202,799
Fishing apparatus, O. Heese.....	202,818
Fluting device, J. & E. Shane & Hooker.....	202,699
Fluting iron, N. B. Streeter.....	202,676
Fruit drier, H. Brown.....	202,699
Fuel box, W. McCarroll.....	202,847
Funnel, D. B. Lester.....	202,734
Furnace, boiler, J. Jenks.....	202,667
Furnace, metallurgic, T. D. Morgan.....	202,748
Furnace, reverberating, W. Mann.....	202,845
Furnace, smoke consuming, A. Gross.....	202,646
Furnace fire lining and back, O. Earnshaw.....	202,687
Furnaces, gas check for blast, D. N. Jones.....	202,730
Garlic separator, Shamberger & Carroll.....	202,761
Gas lighting burner, A. L. Bogart.....	202,694
Gate, B. B. Huntington.....	202,728
Glass, annealing, H. Gerke.....	202,809
Glassware, machine for finishing, D. Challinor.....	202,631
Glassware, ornamenting, A. Harcum.....	202,647
Governor, H. Towns.....	202,892
Grain band, G. A. Brackett.....	202,697
Grain bin, J. A. Wolfey.....	202,911
Grain binder, N. B. Fassett.....	202,608
Grain binder, Olmsted, Travis & Chute.....	202,747
Grain separator, J. M. F. W. & C. V. Herman.....	202,721
Grain separator, M. H. Pitts.....	202,863
Grinding machine, A. E. Elmer.....	202,640
Grinding machine, J. Hunkeler.....	202,656

Grinding machine, A. Warth.....	202,890	Timber, preserving, W. Thilmany.....	202,878
Hammer, E. F. Hanks.....	202,814	Tobacco, treating, J. Trent.....	202,880
Harness pad, J. T. Smith.....	202,879	Tobacco stem crusher, N. H. Borgfeldt.....	202,886
Harrow, J. H. Barr.....	202,780	Toy, S. Potts.....	202,754
Harrow, S. M. Skinner.....	202,871	Toy pistol, C. Mohr.....	202,742
Harrow, G. Watt, Sr.....	202,808	Toy vehicle, F. B. Hoard.....	202,651
Harrow, etc., machine, G. W. & H. F. Roberson.....	202,873	Trace coupling, J. Fournay.....	202,806
Harvester, N. B. Fassett.....	202,803	Transplanter and hoe, M. Wilson.....	202,909
Hat pounding machine, W. Keenan.....	202,829	Tread mill, R. A. Brown.....	202,788
Hat pressing machine, A. Algeo.....	202,823	Truck, car, Marsters & Fisher.....	202,787
Head light, Dressell, E. H. & J. G. Voth.....	202,711	Truck, car, C. Speidel.....	202,881
Heating apparatus, J. P. Avery.....	202,776	Truss, L. T. J. Lubin.....	202,842
Hog cholera compound, A. J. Guilan.....	202,811	Umbrella tip cup, A. Dittich.....	202,710
Horse cleaner, M. P. Washburn.....	202,769	Valve, F. Brown.....	202,785
Horse collar, M. Turley.....	202,805	Valve for barrels, etc., J. Byrne.....	202,629
Horse power, M. H. Pitts.....	202,862	Vehicle, side spring, Milligan & Wood.....	202,741
Horseshoe, J. A. Bladon.....	202,758	Vehicle, side spring, W. L. Weston.....	202,904
Horseshoe nail machine, J. T. Hough.....	202,824	Velocipede, H. F. Parsons.....	202,695
Hub attaching device, J. C. Hendry.....	202,726	Ventilator for houses, J. E. Richard.....	202,869
Hydrant, P. Connolly.....	202,793	Ventilator, louver, J. F. Starr, Jr.....	202,765
Hydraulic power accumulator, T. M. Maguire.....	202,690	Vessel, compartment, J. Butcher.....	202,701
Ice in separated layers, forming, A. C. Call.....	202,787	Wagon, dumping, J. H. Nelson.....	202,745
Indicator, wind, A. J. & F. E. Harris.....	202,815	Wagon top, V. B. Grinnell.....	202,810
Indicator, J. Freeman.....	202,648	Washing machine, J. G. Beardsley.....	202,781
Insect powder gun, W. Kennish.....	202,890	Washing machine, J. J. Straub.....	202,887
Ironing table, F. M. Smith.....	202,877	Washing machine, C. Thompson.....	202,889
Jar, fruit, J. H. Phillips.....	202,758	Water closet, M. Hogan.....	202,652
Knife scourer, N. A. Wierman.....	202,770	Water closet, drip tray, C. Harrison (r).....	8,189
Knitting machine, W. T. Lemon.....	202,840	Water meter, J. Johnson.....	202,827
Ladder, P. Butan.....	202,876	Water raising apparatus, D. M. Smyth.....	202,764
Lamp, W. Boekel.....	202,696	Weather strip, D. S. Wood.....	202,912
Lamp, W. M. & J. J. Walton.....	202,681	Well boring and rock drilling, J. P. Summers.....	202,677
Lantern, Baron, Cash & Rankin.....	202,779	Wells, lining bored, J. Dollard.....	202,796
Lantern, F. J. & G. A. Whiteher.....	202,687	Wheels, scraper for vehicle, M. Robbins.....	202,872
Lathe chuck, J. E. Layey.....	202,836	Whiffletree hook, N. Hill.....	202,649
Leather folding machine, R. H. Lufkin.....	202,844	Whip rack, S. A. Darrah.....	202,794
Letter sheet and envelope, L. H. Rogers.....	202,874	Windmill, S. E. Jarvis.....	202,826
Lifting jack, J. M. McClintock.....	202,849	Wire rolling machine, Shaw & Spence.....	202,670
Lifting jack, N. McIntyre.....	202,739	Wire rolling machine, guide for, W. W. McCallip.....	202,848
Lifting jack, O. V. Price.....	202,686	Wire rope and cable, T. Hager.....	202,812
Log turner, Driscoll & Balcom.....	202,712	Wool, etc., separating, J. Y. Slater.....	202,672
Logotype manufacture, G. W. Glasier.....	202,716		
Loom picker, J. M. Parker (r).....	8,191		
Looms, picker strap for, E. S. Stone.....	202,875		
Lubricator, G. H. Hoagland.....	202,820		
Lubricator, C. D. Lynch.....	202,786		
Mailing package, F. J. Grotevent.....	202,720		
Mandrel, expanding, F. H. Vannam.....	202,768		
Mechanical movement, J. C. Davis.....	202,707		
Medical compound, H. Falk.....	202,801		
Micrometer gauge, G. M. Pratt.....	202,866		
Military accoutrements, G. H. Palmer.....	202,693		
Millstones, balancing, H. H. Kendrick.....	202,731		
Moulded articles, composition for, W. H. Dibble.....	202,686		
Motion, device for converting, A. G. Smyth.....	202,880		
Motor, W. K. Asbill.....	202,626		
Neck tie shield, Smith & Thayer.....	202,673		
Nozzle, bellows, T. H. Bullock.....	202,700		
Nut lock, Bailey, Emmert & Capps.....	202,690		
Nut lock, J. L. Hayward.....	202,723		
Nut lock, A. Needs.....	202,869		
Oil, machine for extracting, A. B. Lawther.....	202,889		
Oil, machine, S. Hutchinson, Jr.....	202,729		
Paper barrel, Thomson & Naylor, Jr.....	202,860		
Paper ball, A. & I. Jennings (r).....	8,190		
Paper pulp stock grinder, F. A. Cushman (r).....	8,197		
Paper pulp wood grinder, F. A. Cushman (r).....	8,198		
Paper tubes, making, A. G. Batchelder (r).....	8,196		
Pen point, fountain, J. Holland.....	202,665		
Pens, stenoiding, F. P. Woodbury.....	202,718		
Pencil, J. Holland.....	202,664		
Pin, clothes, Clark & Smith.....	202,704		
Pins, cutting wooden, B. Chalfant.....	202,702		
Pistol holster, W. N. Le Page.....	202,738		
Pitchforks, making, H. B. Kinney.....	202,698		
Plane, J. F. Smith.....	202,674		
Planter and fertilizer distributor, Smith & Boyle.....	202,878		
Planter, R. H. A.....	202,626		
Plow, G. S. Haver.....	202,817		
Plow, J. Oldendorph, Jr.....	202,746		
Plow, G. W. & W. F. Wimpsey.....	202,698		
Plow colter, J. Augspurger.....	202,624		
Pocketbook clasp, L. Prashar.....	202,755		
Press, copying, E. H. T. C. Rath.....	202,756		
Press, hay and cotton, M. Lahaussois.....	202,835		
Printers, roller composition for, A. Van Bibber.....	202,897		
Printing apparatus, Hillen & Crockett.....	202,650		
Printing machines, lapping for, Jilison & Smith.....	202,826		
Pulley, loose, J. Saiter, Jr.....	202,667		
Pulp grinding machine, J. W. Brightman.....	202,698		
Pump, Lucase & Newell.....	202,650		
Pump, ammoniacal gas, J. Enright.....	202,641		
Pump, chain, G. B. Valentine.....	202,896		
Pump, cream, G. A. Baron.....	202,778		
Pump, double-acting, C. Helster.....	202,725		
Pump, double-acting, N. Clute.....	202,688		
Pumping machine, A. H. Low.....	202,841		
Rail, compound, C. Conrad.....	202,685		
Railway switch, J. W. Close.....	202,682		
Railway turn-table, locking, E. H. Johnston.....	202,838		
Rake, horse hay, E. Knapp.....	202,853		
Rake, horse hay, S. Ritty.....	202,871		
Refrigerator, A. C. Rand.....	202,867		
Roof battening, N. H. Brown.....	202,784		
Roofing fabric, C. M. Warren.....	202,902		
Setchel, A. McKinnon.....	202,860		
Sewing machine, G. Schlichter.....	202,698		
Soles, weighing, T. Fairbanks.....	202,800		
Settee, folding, H. T. L. B. & F. F. Morse.....	202,856		
Sewing machine, J. McCloskey.....	202,738		
Sewing machine, Morrell & Parkinson.....	202,857		
Sewing machine, broom, C. Palmer.....	202,749		
Sewing machine, glove, C. M. Boland.....	202,695		
Sewing machine presser foot, T. P. West.....	202,771		
Sewing machine trimmer, J. E. Wilson.....	202,908		
Sewing machine work trimmer, H. H. Hallett.....	202,721		
Sifter, clay, N. Goddard.....	202,717		
Skirt exhibitor, G. W. Everett.....	202,713		
Sleeve supporter, J. P. Lindsay.....	202,735		
Slimes, machine for drying, J. W. Dillon.....	202,709		
Soap crutching machine, S. Struns.....	202,896		
Spark arrester, C. E. Wyman.....	202,914		
Speculum, J. C. Hall.....	202,813		
Spring, vehicle, W. Michael.....	202,852		
Spring, vehicle, Muldoon & Davis.....	202,858		
Stamp, hand, E. D. Chamberlain (r).....	8,201		
Stamp, postage, J. Sangster.....	202,780		
Staple hook, N. Burnham.....	202,736		
Starch, process of drying, T. Kingsford.....	202,832		
Steam trap, J. Ryan.....	202,759		
Steamer, feed, Darling, Parrish & Wendell.....	202,706		
Stench trap, E. G. M. Nowell.....	202,800		
Stills, L. Bordewich.....	202,782		
Stove back, portable, W. C. Barkalow.....	202,777		
Stove bottom, G. S. Stannard.....	202,838		
Stove, F. J. Gould.....	202,718		
Straw cutter, G. R. Pierpont.....	202,751		
Stretching and wheeled frame, Rice & Childs.....	202,898		
Surveying instrument, tripod head, A. Young.....	202,916		
Swivel back, A. Wallach.....	202,898		
Telephone transmitter, G. B. Richmond.....	202,870		
Thill coupling, E. H. Mason.....	202,848		

TRADE MARKS.

Ague cures, M. C. White.....	5,988
Axes, Markley, Alling & Co.....	5,901
Bitters, Alphonse Walz.....	5,936
Boots and shoes, E. H. Stark & Co.....	5,905
Bread raising preparations, D. & L. Slade.....	5,984
Bronchial lozenges, C. F. Asche.....	5,988
Burning fluids, J. G. Gorrell.....	5,922
Caps for toy pistols, etc., E. H. Wander.....	5,915
Catarrh remedy, F. W. Wei De Meyer.....	5,943
Chemical products, Solvay & Co.....	5,946
Chemical solution for preserving dead bodies, Rodgers Alleton Company.....	5,988
Chewing and smoking tobacco, J. B. Pace.....	5,912
Chewing tobacco, J. W. & C. G. Holland.....	5,923
Cigars and tobacco, S. Jacoby & Co.....	5,944
Cigars and tobacco, Lichtenstein Bros. & Co.....	5,909
Cigars, Theodore Schunemann.....	5,913
Cigars and tobacco, Joseph Loewenhers.....	5,926
Cigars, Celestino Palacio.....	5,930
Collars, Pine, Adams & Dunham.....	5,929
Compressed yeast, Oscar King.....	5,910
Corsets and waists, J. G. Fitzpatrick.....	5,921
Cotton goods, J. Caswell & Co.....	5,988
Cotton yarn, L. G. Hansen.....	5,984
Cough mixture, Rhodes & Lewis.....	5,982
Door springs, Van Wagoner & Williams.....	5,942
Files, Western File Company.....	5,989
Italian paste, H. K. & F. B. Thurber & Co.....	5,907
Lace articles, George Cox.....	5,918
Liquid drier, A. W. Pratt & Co.....	5,928
Medicine, Powell & Turner.....	5,902
Medical compound, Dundas Dick.....	5,920
Medicinal preparation, C. W. Scott.....	5,985
Medical preparation, W. L. Keller.....	5,900
Ostrich feathers, etc., Welch & Creighton.....	5,914
Paper, Crane Brothers.....	5,919
Paper bags, Smith, Dixon & Co.....	5,937
Paper carpets, etc., T. S. Scott & Bro.....	5,904
Prepared calcimine, G. I. Stevens.....	5,906
Preparations of witch-hazel, Fred. Humphreys.....	5,925
Pile cure, S. J. Cox & Co.....	5,908
Scrap books, Slote, Woodman & Co.....	5,896
Screw cap for fruit jars, etc., The Con. Fruit Jar Co.....	5,947
Sewing machines, Providence Tool Company.....	5,895
Shirts, C. H. Buck.....	5,917
Shirts, C. L. Smith.....	5,908
Smoking tobacco, Oliver & Robinson.....	5,927
Smoking tobacco, B. F. Weyman.....	5,948
Steam engines, Armstrong & Sims.....	5,916
Toweling, Wilmerding, Biddle & Biset.....	5,887
Whisky, A. & H. Myers.....	5,911
Worsted braid, A. C. Haynes.....	5,924

DESIGNS.

Advertising monuments, J. B. Turner.....	10,649
Cabinet jewelry, W. A. L. Miller.....	10,630
Glassware, T. B. Atterbury.....	10,643
Match safes, J. H. Davis.....	10,644
Packages, Samuel Kimberly.....	10,647
Pistol handles, Harrington & Richardson.....	10,646
Scarf pin, Henry Griffith.....	10,645
Jewel case, E. H. Zoepfel.....	10,651
Jewelry, Abraham Steinman, Jr.....	10,648

FOR THE WEEK ENDING APRIL 16, 1878.

TRADE MARKS.

Baking powder, Cleveland Brothers.....	5,875
Biscuits, E. J. Larrabee & Co.....	5,885
Builders' hardware, Russell & Erwin.....	5,886
Cassimere, Franklin Glaser.....	5,879
Chains, The Smith & Egge Manuf. Co.....	5,890
Cigars, G. Fehi & Co.....	5,882
Cigars, cigarettes, etc., Stratton & Storm.....	5,887
Cigars, D. E. Rose.....	5,886
Coffee, Coelho & Mohlfeld.....	5,861
Coffee, spices, etc., Weikel & Smith Spice Co.....	5,891
Coffees, spices, etc., Weikel & Smith Spice Co.....	5,899
Dental supplies, H. D. Justi.....	5,882
Essential oils, J. J. Quetting.....	5,885
Gloves, George Lianer.....	5,883
Leather, Ordway & Clark.....	5,894
Lounges, W. E. Buser.....	5,874
Medical compound, C. T. Swift.....	5,888
Mineral water, T. F. Goode.....	5,878
Organ mechanism or action, E. P. Carpenter.....	5,860
Paints, L. B. Stone.....	5,899
Pills, E. H. Barnum.....	5,878
Playing cards, V. E. Manger.....	5,870
Ready mixed paints, Norton & Wieder.....	5,871
Ribbons, Meyer & Dickinson.....	5,863
Roasted and ground coffee, Fink, Brother & Co.....	5,877
Salt, H. K. & F. B. Thurber & Co.....	5,872
Saws and files, Emerson, Smith & Co.....	5,876
Smoking tobacco, B. Leidersdorf & Co.....	5,887
Smoking, etc., tobacco, Rowland & Newbrandt.....	5,884
Soap, B. T. Babbitt.....	5,887
Tea, J. R. Walsh.....	5,892
Tobacco and cigars, A. E. Irwin.....	5,881

Toys, J. A. Crandall.....	5,899
Wines and brandies, J. Calvet & Co.....	5,858
Woven cotton fabrics, Minot, Hooper & Co.....	5,865
Wrench, Girard Wrench Manuf. Co.....	5,890
Writing paper, Byron Weston.....	5,898

DESIGNS.

Badge, Henry Moesinger.....	10,639
Badge, R. O. Wood.....	10,636
Billiard table leg, H. W. Collender.....	10,637
Billiard table leg, H. H. Holly.....	10,638
Billiard table leg, Oscar Norman.....	10,639
Bracelet, J. A. Hedstrom.....	10,642
Burial caskets, W. J. Noble.....	10,680
Carpets, T. J. Stearns.....	10,633
Casket screw, Rogers & Huggins.....	10,631
Child's dress, John McNeven.....	10,634
Clock face, George Ager.....	10,625
Clock case, M. C. Jones.....	10,628
Crochet fabric, C. A. Burnham.....	10,626
Organ case, Samuel Hayward.....	10,635
Pendulum weight, George Hoyting.....	10,627
Sheet metal water pipe, J. F. Starr, Jr.....	10,632
Writing paper, M. H. Pirie.....	10,640

English Patents Issued to Americans.

April 28 to May 9, inclusive.

Anti-friction bearings.—J. C. Thompson, Brooklyn, N. Y.	
Balance.—F. Fairbanks, St. Johnsbury, Vt.	
Boot and shoe lasting machine.—H. G. Thompson, Milford, Conn.	
Carburetor feed regulator.—B. Chollar, Chicago, Ill.	
Caster for furniture.—C. E. Parent, New York city.	
Concrete.—J. S. Wethered, New York city.	
Firearm, repeating.—B. C. Gough, Canton, Mass.	
Folding and printing machine.—C. Chambers, Jr., et al., Philadelphia, Pa.	
Grinding mill.—P. T. Elting, Boston, Mass.	
Inspirator.—H. M. Whitney, Boston, Mass.	
Lacing hooks.—E. I. ayna, Boston, Mass.	
Loom.—H. Woodman, Saco, Me.	
Loom shuttle.—W. A. Doherty et al., Fall River, Mass.	
Loom shuttle.—J. M. Palmer et al., Cambridge, Mass.	
Motor.—C. Huebner et al., Newark, N. J.	
Pulley.—W. Webster, Washington, D. C.	
Railway spring.—G. E. Gray, San Francisco, Cal.	
Railway switch.—D. Tracy, Ridgewood, N. J.	
Recording and reproducing sounds.—T. A. Edison, Menlo Park, N. J.	
Refrigerator car.—W. D. Mann, Mobile, Ala.	
Sea sickness, preventing.—J. C. Thompson, B'klyn, N.Y.	
Sewing machine.—D. H. Campbell, Pawtucket, R. I.	
Silicious compound.—J. W. Hyatt, Newark, N. J.	
Slate for drawing.—C. C. Shepherd, Passaic, N. J.	
Stone, artificial.—J. H. Thorp, New York city.	
Sugar cutting machine.—W. Jasper et al., San Francisco, Cal.	
Tape measure.—A. F. Ward, Philadelphia, Pa.	
Telephone.—J. F. Bailey, New York city.	
Terra alba substitute.—C. T. Tomkins, New York city.	
Watch balance.—C. v. d. Woerd, Waltham, Mass.	
Wire rolling machine.—D. Shaw et al., Pittsburg, Pa.	

Advertisements.

Inside Page, each insertion --- 75 cents a line.
 Back Page, each insertion --- \$1.00 a line.
 (About eight words to a line.)
 Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

JAPANESE ART MANUFACTURES.

By Christopher Dresser, Ph.D., etc. Paper read before Society of Arts. The Japanese Potter at Work. Curious mode of Making Scarfs. How the Japanese Print on Cloth. Japanese Process for Silk Ornamentation. Japanese Weaving. How Fine Japanese Fans are made. Japanese Method of Making Moulds for Ornamental Castings for Vessels, Bronzes, etc. Japanese Lacquer Work. The Love and Pursuit of the Beautiful in Japan. A very entertaining, instructive, and comprehensive paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 115. Price 10 cents. To be had at this office and of all newdealers.

WALTHAM WATCHES.

We beg to announce that we have recently entirely remodeled the very popular grades of full-plate movements, known by the marks, "Wm. Ellery," "Apoleton, Tracy & Co.," "Waltham Watch Co.," "P. S. Bartlett," and "Broadway," giving to them not only a highly improved appearance, but great additional value. We embody in them such of the best results of our experience and study for twenty years as can be useful in this popular form of watch. We give these new model watches special recommendation to all who look for good performance and solid excellence at moderate cost. The alterations have been made with the view of pleasing practical watch makers, as well as watch wearers.

No watches retailed by the Company. Apply to your local jeweler.

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ROBBINS & APPLETON,
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Perfect Substitute for Wood-Cuts.

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State where you saw this.

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Can be attached to any hydrant and used for driving small machinery. Lightest running motor in existence. For pamphlet, address H. M. A., Portland, Oregon.

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Address C. S. HOWELL,
Eagle Wire Mills, Imlay Street, Brooklyn, N. Y.

Address ALONZO FLACK, Pres., for special terms at Claverack (N. Y.) College. All appointments the best.

\$16.00 only for H. Weindel's
Double Acting Imp'd Air Pump.
More air and higher pressure (up to 40 lbs. per inch) than any other.
Hundreds of references.
Office 1954 Darien St., Philadelphia.

WHISKERS can be grown on the smoothest face in a few weeks by the use of **INCINO**, a New discovery. One bottle Free. Send stamp for particulars. **INCINO CO.**, 264 Main St., Cincinnati, Ohio.

PAINT IN CONSTRUCTION. BY Robert Grimshaw, C.E. Peculiarities and Chemical Constitution of Paris White, White Lead, Zinc White, Baryta White, Blende, Antimony White, Iron Oxide, Red Lead, Prussian Blue, Cobalt Blue, Smalt, Coal Tar, Soluble Glass, Yellow Ochre, Raw Sienna, Fuller's Earth, Lampblack, with valuable Practical Hints. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 125**. Price 10 cents. To be had at this office and of all newsdealers.

Particulars of Smithography. Ag'ts' Directory, copy Ag'ts' Herald, &c., free. Lum Smith, Phila., Pa.

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TURBINE WATER WHEELS
ALCOOT'S
MANUFACTURED AT MOUNT HOLLY N.J.

GAS, WITHOUT HEAT OR HOLDER, furnished to families at \$5 a year by the "People's Gas Machine." Cost of Machine, \$150. New England for sale. Address JOSIAH REED, Troy, Ohio.

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A copy of Brown's Illustrated Shakespearean Almanac for 1878, together with a copy of his illustrated paper, the *Growing World*, which is devoted to natural history, will be sent to any one free who will send his address on a one cent postal card. Address DR. O. P. BROWN, 21 Grand St., Jersey City, N. J.

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D. H. WILSON & CO., 230 Washington
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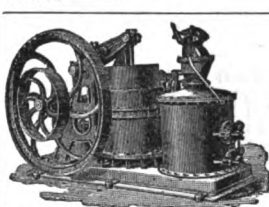
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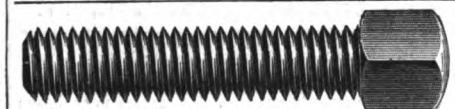
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EDISON'S MICRO-TASIMETER.

The latest of Edison's inventions, and perhaps the most interesting to physicists, is his micro-tasimeter, or measurer of infinitesimal pressure.

The thermopile, hitherto foremost among delicate indicators of changes of temperature, must now be consigned to the rear ranks, and the radiometer, which exhibits the motive power of the most subtle of forces, must retire in favor of an instrument that can weigh that force.

The micro-tasimeter is the outcome of Professor Edison's experiments with his carbon telephone. Having experimented with diaphragms of various thicknesses, he ascertained that the best results were secured by using the thicker diaphragms. At this stage he experienced a new difficulty. So sensitive was the carbon button to changes of condition, that the expansion of the rubber telephone handle rendered the instrument inarticulate, and finally inoperative. Iron handles were substituted with a similar result, but with the additional feature of musical and creaky tones distinctly audible in the receiving instrument. These sounds Professor Edison attributed to the movement of the molecules of iron among themselves during expansion. He calls them "molecular music." To avoid these disturbances in the telephone, the handle was dispensed with; but it had done a great service in revealing the extreme sensitiveness of the carbon button, and this discovery opened the way for the invention of the new and wonderful instrument.

The micro-tasimeter is represented in perspective in Figs. 1 and 2, in section in Fig. 3, and the plan upon which it is arranged in the electric circuit is shown in Fig. 4.

The instrument consists essentially in a rigid iron frame for holding the carbon button, which is placed between two platinum surfaces, one of which is fixed and the other movable, and in a device for holding the object to be tested, so that the pressure resulting from the expansion of the object acts upon the carbon button.

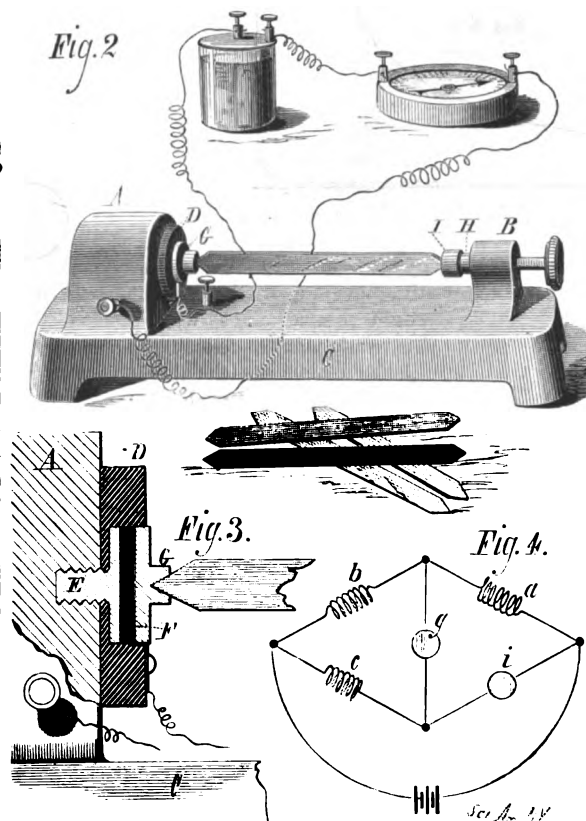
Two stout posts, A, B, project from the rigid base piece, C. A vulcanite disk, D, is secured to the post, A, by the platinum-headed screw, E, the head of which rests in the bottom of a shallow circular cavity in the center of the disk. In this cavity, and in contact with the head of the screw, E, the carbon button, F, is placed. Upon the outer face of the button there is a disk of platinum foil, which is in electrical communication with the battery. A metallic cup, G, is placed in contact with the platinum disk to receive one end of the strip of whatever material is employed to operate the instrument.

The post, B, is about four inches from the post, A, and contains a screw-acted follower, H, that carries a cup, I, between which and the cup, G, is placed a strip of any substance whose expansibility it is desired to exhibit. The post, A, is in electrical communication with a galvanometer, and the galvanometer is connected with the battery. The strip of the substance to be tested is put under a small initial pressure, which deflects the galvanometer needle a few degrees from the neutral point. When the needle comes to rest, its position is noted. The slightest subsequent expansion or contraction of the strip will be indicated by the movement of the galvanometer needle. A thin strip of hard rubber, placed in the instrument, exhibits extreme sensitiveness, being expanded by heat from the hand, so as to move through several degrees the needle of a very ordinary galvanometer, which is not affected in the slightest degree by a thermopile facing and near a red hot iron. The hand, in this experiment, is held a few inches from the rubber strip. A strip of mica is sensibly affected by the heat

of the hand, and a strip of gelatin, placed in the instrument, is instantly expanded by moisture from a dampened piece of paper held two or three inches away.

For these experiments the instrument is arranged as in Fig. 2, but for more delicate operations it is connected with a Thomson's reflecting galvanometer, and the current is regulated by a Wheatstone's bridge and a rheostat, so that the resistance on both sides of the galvanometer is equal, and the light-pencil from the reflector falls on 0° of the scale. This arrangement is shown in Fig. 1, and the principle

is illustrated by the diagram, Fig. 4. Here the galvanometer is at *g*, and the instrument which is at *i* is adjusted, say, for example, to ten ohms resistance. At *a*, *b*, and *c* the resistance is the same. An increase or diminution of the pressure on the carbon button by an infinitesimal expansion or contraction of the substance under test is indicated on the scale of the galvanometer.

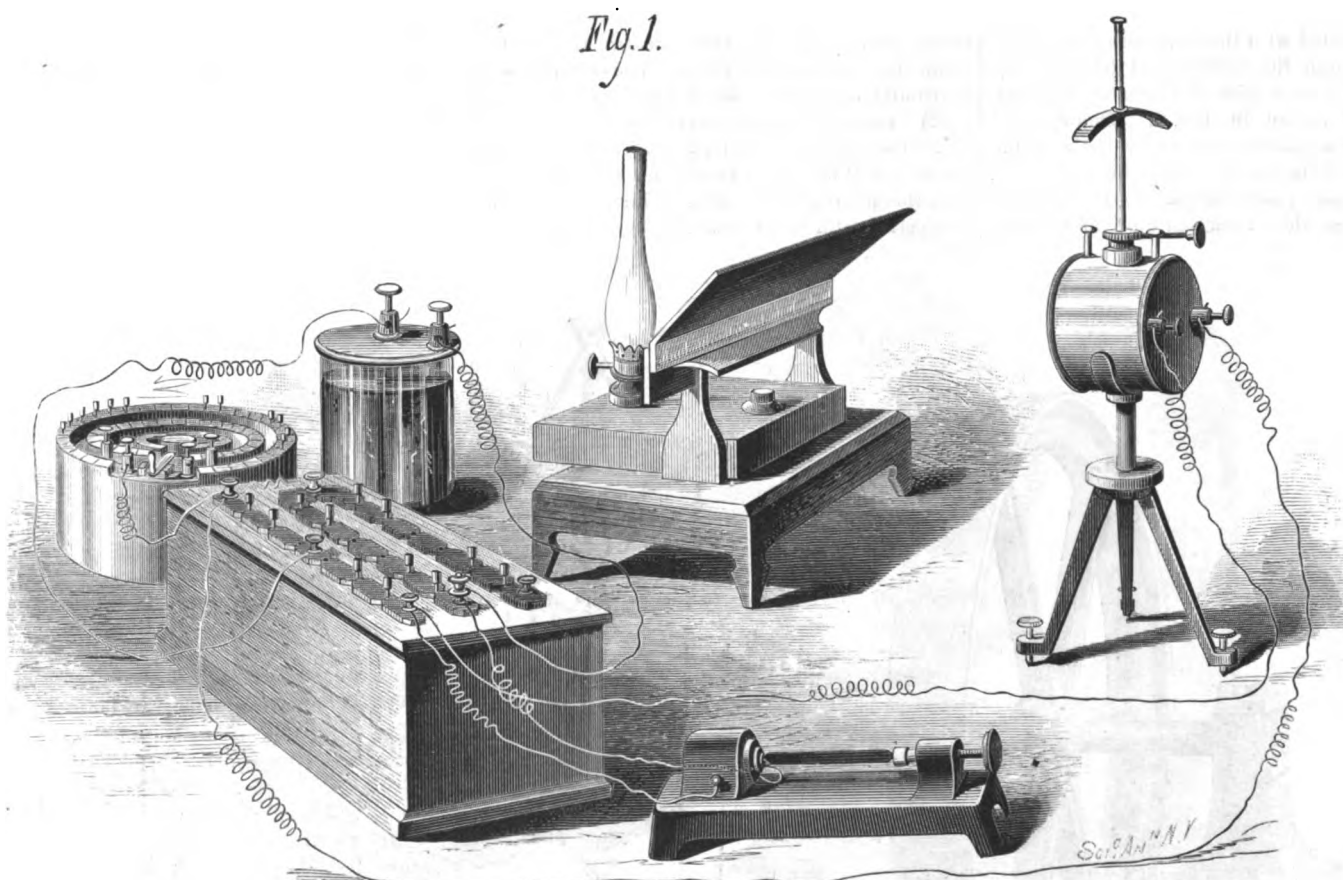


The carbon button may be compared to a valve, for, when it is compressed in the slightest degree, its electrical conductivity is increased, and when it is allowed to expand it partly loses its conducting power.

The heat from the hand, held 6 or 8 inches from a strip of vulcanite placed in the instrument—when arranged as last described—is sufficient to deflect the galvanometer mirror so as to throw the light-beam completely off the scale. A cold body placed near the vulcanite strip will carry the light-beam in the opposite direction.

Pressure that is inappreciable and undiscoverable by other means is distinctly indicated by this instrument.

Professor Edison proposes to make application of the



EDISON'S MICRO-TASIMETER.

principle of this instrument to numberless purposes, among which are delicate thermometers, barometers, and hygrometers. He expects to indicate the heat of the stars and to weigh the light of the sun.

NOTE BY PROFESSOR EDISON.

The heat measurer was described and experiments shown to Professor Langley, the well known astronomer of the Alleghany Observatory, some six months ago. On his suggestion at the time, that it ought to be worked up as a very valuable boon to science, especially in the line he was

investigating (that is, measuring the heat of the stellar spectra), I tried many experiments with it and devised the form given. This apparatus was described to various members of the National Academy of Sciences, held at Washington, April 17, 18, and 19, 1878, and the *Washington Star* and *Union* newspapers published then gave a description of the instrument. Copies of these papers were at once mailed to William H. Preece, Professor Scheelen, Count Du Moncel, and other physicists in Europe.

A River Reversed.

A natural river begins in countless little runlets, which unite in a network of larger streams, to unite in their turn in still larger ones, until a strong current receives the united flow from all. The sunless stream that supplies a great city, like New York, reverses all this. It begins at a single stream and ends at a million outlets. The network of pipes through which the Croton is delivered aggregates a length of 440 miles, and the daily flow averages 85,000,000 gallons.

GOOD WORK FROM CHEAP PATENTS.

It is not long since a prominent Englishman urged as an objection to cheap patents the comical plea that they gave an unnatural impulse to the inventive faculty, thereby fostering a preference for mere cleverness over honest work. As an awful example he pointed to the United States, "where the factitious value attached to inventions has tended to produce an almost total sacrifice of solid workmanship to flimsy ingenuity." A very pretty comment on this charge may be found in the explanation given in the leading English papers of the secret of the dangerous character of American competition in cottons and other manufactures. The danger lies, they admit, not so much in the cheapness of American goods as in their superior quality and finish. Where they are known, American cottons are preferred to those of England in the great markets of the East, even at a higher price, because they are honestly made. The *Saturday Review* attributes the decline and threatened loss of England's trade in the East as much to "the fraudulent folly of English manufacturers, who have lost their customers by palming off on them adulterated goods," as to the natural advantages of American manufacturers. In like manner the *London Times* attributes the increase of American manufactures, and their successful competition with those of England, to their superiority as well as to genuine domestic advantages in the processes of manufacture. A Swiss commissioner to the Philadelphia Exhibition writes to his countrymen: "Have you ever compared a rake, a spade, a knife, a hatchet, made in America, with tools made here? How much is Europe left behind! While our constructors aim generally at products heavy, massive, solid, in appearance, and save rather in the quality of the metal than on the weight, American workmanship is light, pleasing to the eye, and employs almost exclusively good material."

At the exposition of objects of art at Munich there was nothing in cast iron which could be compared with a stove which he had brought from America. "Not merely for the good quality of the casting, but also in the ornamentation." Again, he says: "Who does not know American sewing machines? And who has not already become satisfied, even when machines of the same kind are made in Europe in enormous quantities, that the somewhat higher price of the American machines is largely compensated for by their construction, their solidity, and their convenience?" So far from finding in American products

any sacrifice of solid workmanship to flimsy ingenuity, this critical observer pronounces them generally "handsome, solid, practical, light, and of good material," and the verdict of buyers, the world over, confirms his testimony.

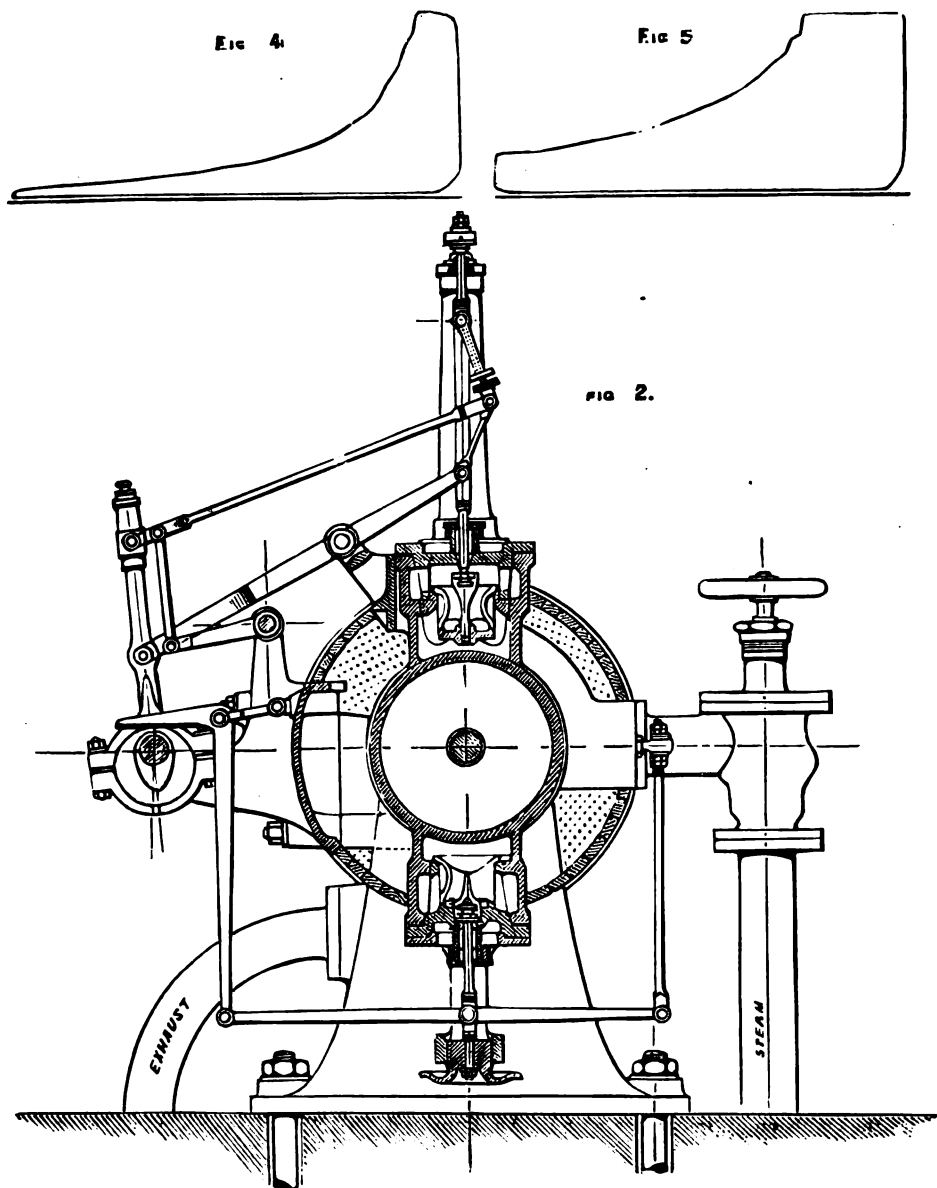
NEW WHEEL TIRE.—A new wheel tire has been recently invented. It consists in passing around the usual iron tire a rubber tire, and around this again an iron tire made in sections, so that each section may yield inward as the weight comes upon it. It is said to lessen noise, jarring, and wear.

COLLMANN'S VALVE GEAR.

We illustrate on this page a system of valve gear, recently invented by Herr A. Collmann, of Vienna, which, in certain points, resembles the well known Corliss and Sulzer gears. In our engravings (which we copy from *Engineering*), Fig. 1 is a perspective view, taken from a photograph

connected by a light link to the lower end of a little buffer rod working in a socket which is itself jointed above directly to the valve spindle. The pin on the buffer rod is connected by a long link to a block capable of sliding on the upper end of the eccentric rod, which is made cylindrical for that purpose. Suppose this block to be fixed on

end of the socket rests on the buffer plate (which is covered with leather), and as the eccentric descends the latter is lifted (by the action of the lever), and the valve is thereby opened. As the eccentric descends the valve receives a motion determined jointly by the motions of the eccentric and its rod. The former by itself would lift the valve; the upper end of



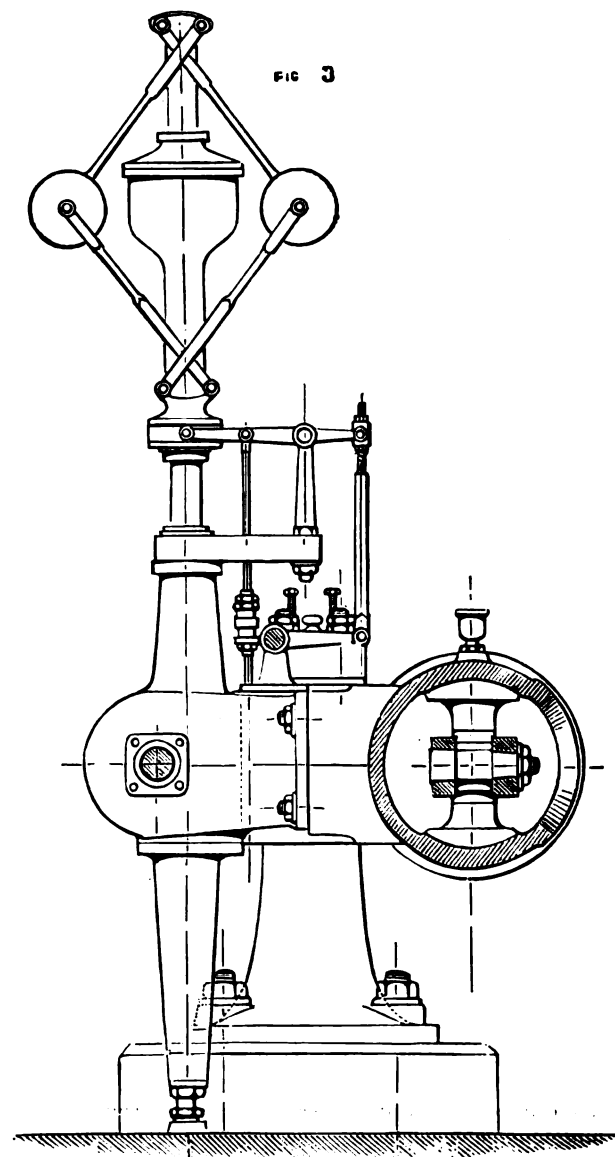
SECTION THROUGH CYLINDER.

of a horizontal engine fitted with the Collmann gear; Figs. 2 and 3 are sections through the cylinder and the guides respectively; Figs. 4 and 5 are copies of indicator diagrams taken from the engine shown in Fig. 1. Double beat valves are used, two for admission on the top of the cylinder, and two for exhaust below it. All four valves are worked from a horizontal shaft parallel to the axis of the cylinder, driven from the crank shaft by miter gear. The governor (Figs. 1 and 3), of an approximately isochronous type, is driven from this shaft through a pair of screw wheels. The exhaust valves are worked by cams through an arrangement of lever shown plainly in Fig. 2. These valves are lifted by the cams and allowed to drop shut by their own weight, and that of the levers and rods connected with them.

The mode of working the steam valves is, however, the characteristic feature of this gear. Referring to Figs. 1 and 2, it will be noticed that on the auxiliary shaft there are two eccentrics, one for each valve. A pin in the eccentric rod is jointed directly to one end of a lever working on a horizontal axis fixed to the cylinder. The other end of the same lever is

connected by a light link to the lower end of a little buffer rod working in a socket which is itself jointed above directly to the valve spindle. The pin on the buffer rod is connected by a long link to a block capable of sliding on the upper end of the eccentric rod, which is made cylindrical for that purpose. Suppose this block to be fixed on

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SECTION THROUGH GUIDES.

the rod, however, comes continually nearer the cylinder, and by so doing pushes away the lower end of the buffer rod, a motion which would, by itself, tend always to leave the valve free to drop shut again. The particular point at which the valve does actually close will depend upon the position of the sliding block on the eccentric rod. The higher this is the greater will its motion be, the further will the knee be pushed out for any given position of the eccentric, and the earlier, therefore, will the cut-off take place. To make the change of cut-off automatic it is only necessary to control the position of the block on the eccentric rod by the governor, and this is done by the arrangement of levers shown in the engravings.

New Industries.

Within the past few years a great number of new industrial operations have been established in the United States, from which have come two very important results—the employment of labor saving machinery in a cheaper, more rapid production, and the incitement to the greater activity in improvement and invention of appliances. With the fact accomplished that one machine can do the work of

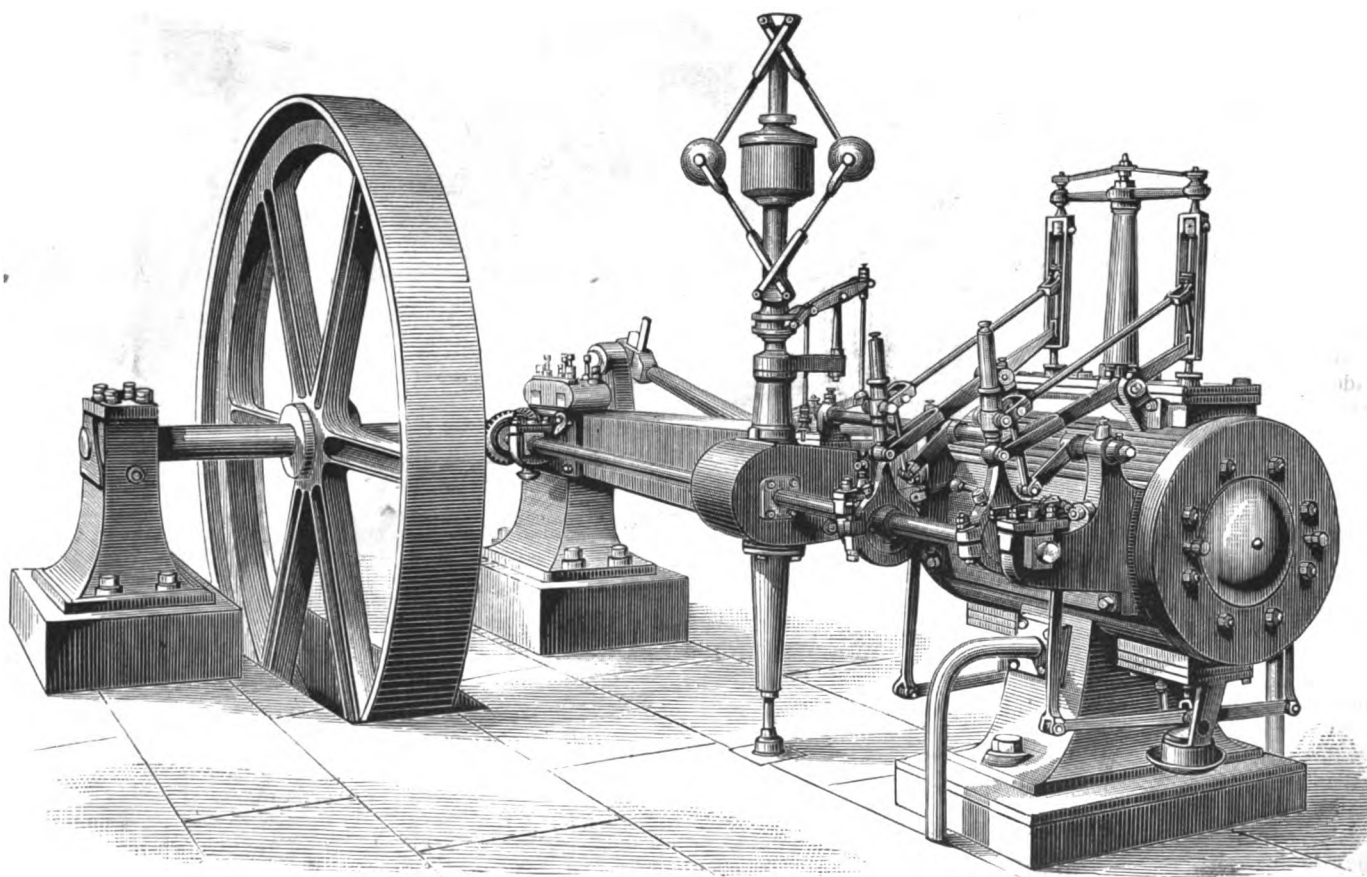


Fig. 1.—HORIZONTAL ENGINE WITH COLLMANN'S VALVE GEAR.

a dozen men, we see the evil of something worse than convict and Chinese cheap labor in our midst. We have an enormous addition to our population in the shape of automatic labor-saving machines. If one superintendent can take care of ten or twenty men, so here one man can take care of a half dozen machines doing each ten men's work. The machines have the advantage that they cost nothing for provisions—slaves unfed, unclothed, and harnessed down for life, breathing steam and living on fire.

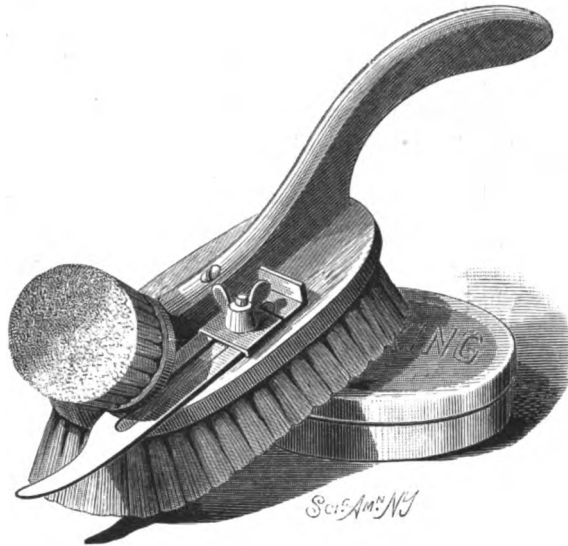
While there is such an enormous increase in the power of production, with no increase in the demand for consumption, it is necessary that much invention and effort should be at work to increase the industrial employment of the people, and to increase the wants and requirements of a higher civilization now rendered feasible. While our people are thus thrown out of one employment, another should be offered. It is a fixed law that every citizen should have what he pays for—all the benefits and opportunities which the nation has power to bestow. Employment is the first right of man; traffic, pleasure, or associations resulting from labor are secondary considerations. To have employment the people of the United States should be engaged in producing everything which the world produces, not incompatible with climate or nature. A close observer of the industrial economy of Germany, France, and Great Britain finds such a number of profitable industries there existing, and of which America has no knowledge, and for the productions of which we pay our money, as would give every person in America steady employment. The care of the United States should be, while affording an asylum to the over-crowded population of other nations, to enable them to bring their industries with them.

AN ETHER ICE-MAKING MACHINE.

The machine shown in the accompanying illustration is one made by Messrs. Duvallon & Lloyd, of Birmingham, England. It uses ether, and the apparatus consists of an engine and air pump combined on the same bed plate, a refrigerator, an ether condenser, a circulating pump, and one or more ice boxes, according to the quantity of ice required. In the machine illustrated the air pump is $9\frac{1}{4}$ inches in diameter, driven direct by a steam engine, with $7\frac{1}{2}$ inch cylinders, the stroke being 21 inches. The two cylinders are arranged in line, the two piston rods being cottered to the crosshead. The guides consist of hollow angle pieces working on the corners of the square bars. The air pump is double-acting. The connecting rods, one at each side of the cylinder, work on crank pins inserted in disks keyed on to the main shaft, one of these disks being of considerable weight, so as to act as a fly wheel. In the center of the main shaft is a pulley for driving overhead shafting, from which the circulating pump and the agitator derive their motion. The two inlet passages of the air pump, one at each end, are connected by a copper pipe, from which branches another copper pipe, placing them in communication with the refrigerator. This is a cylindrical vessel, similar in construction to a multitubular boiler, covered with felt and lagged with wood; the tubes are made of copper and riveted to brass end plates. On the other side of the air pump, the two outlet valves, connected in the same manner as the inlet valves, are placed in communication with the ether condenser, which is similar in construction to the refrigerator, but is of rectangular section and has no copper shell. The tubes communicate at each end with metal chambers, one of them acting as a receptacle for the air which finds its way inside the condenser. The whole is immersed in a tank of wood or galvanized iron, through which a constant stream of water is made to pass for cooling and condensing the vapor of ether. A vacuum of about $25\frac{1}{4}$ inches, it is stated by *Iron*, from which we obtain these particulars, is maintained by the air pump in the refrigerator, vaporizing the ether at a low temperature. The absorption of heat due to this operation lowers the temperature of the strong brine, made to circulate, by means of the pump provided for that purpose, through the tubes and the ice box. The latter is a tank of red deal, varnished inside, with partitions having holes bored in them for allowing the brine to circulate slowly. Between the partitions are suspended zinc moulds of rhombic form, varying in width according to the shape of the blocks of ice required, and filled with pure water.

IMPROVED SHOE BRUSH.

Mr. Frank H. Kean, of Cincinnati, Ohio, has added a useful attachment to blacking brushes, in the shape of an adjustable scraper knife, by which hardened mud, etc., may be easily removed from the shoe. The arrangement of the device is perfectly plain from our engraving. It will be noticed that the knife is curved at its front end, and that by



IMPROVED SHOE BRUSH.

the thumb nut it may be clamped so as to project as much as desired. This device was patented April 30, 1878.

Burns and Scalds.

Dr. G. F. Waters, of Boston, Mass., author of the alkaline treatment, now so widely known for its remarkable success, says:

"My treatment is to apply to the burned surface bicarbonate of soda, if it is a wet surface, in fine powder; but if it is a dry burn, use a paste of bicarbonate of soda and water, or a strong solution of the bicarbonate of soda in water, and apply to the burned surface. This relieves sunburns as well as burns from hot coals, melted sulphur, hot iron, steam, etc.

"Always dispose the burned surface so that the blood can gravitate toward the heart if possible, as otherwise a continuous pain may be felt, due to the dilatation of the blood vessels from the weight of the contained blood.

"If bicarbonate of soda is not at hand, bicarbonate of potash is the next best; biborate of soda does as well, but is not often found handy. Then the emulsion of lime water with oils makes a good dressing where the skin is broken. But

New Inventions.

Mr. W. C. Phillips, of Norwalk, Conn., has invented an improved Stair Fire Escape, made in parts, the number of which in use is determined by the height of the point to be reached, each part consisting of hinged sections capable of being locked in line or at angles by means of bolts operated by cords, suitably braced and capable of a variety of adjustment.

An improved Ice Pitcher, invented by Mr. H. B. Beach, of West Meriden, Conn., has an interior china, glass, or other suitable lining, strengthened by a metallic layer spun around it, and secured to the body of the pitcher by a screw bolt and nut at the bottom. While the usual air space about the bowl is left, the strengthening obviates the danger of cracking the lining by dropping lumps of ice upon it or in case of falling.

Mr. A. R. Sherman, of Natick, R. I., has patented a convenient Book Rack for church pews, in which a number of improvements are introduced, designed to hold the books shut, and also adjustable to hold small books in place.

Mr. H. S. Cate, of Millerstown, Pa., is the inventor of an improved adjustable and removable rubber Packing for Oil Wells, which is attached to the casing head, surrounding the tubing or cable, for the purpose of preserving the vacuum or controlling flowing oil or gas while withdrawing tubing or drilling.

Mr. J. R. Pierce, of Orfordville, N. H., has patented a Horseshoe Spring which is claimed to spread the hoof of a horse's foot without injury and without affecting the attachment of the shoe. The spring is V-shaped, pivoted at its angle to the toe of the shoe, and so formed that its arms extend back along the sides of the frog and bear against the inner sides of the rim of the hoof, at its heels.

Mr. Emerson Cole, of Brooklyn, N. Y., has patented an improved Bung Fastener, made of a tapering pointed strip of sheet metal, having near its wider end burrs, which enter the sides of the bung hole as the bung is driven in with the fastener between it and the hole. The fastener is also made in convenient form to bend over the bung after it is driven in.

An improved Sled, the invention of Mr. R. Armstrong, of Portland, New Brunswick, is so constructed that each runner is allowed sufficient mobility to pass over inequalities of road without disturbing the position of its fellow to any material extent.

In an improved Cooking Stove, patented by Mr. H. R. Smith, of Minnesota Lake, Minn., the arrangement is adaptable to burning hay as well as wood or coal, mainly for the purpose of utilizing the cheap hay crops of the Western States, after the hay is properly prepared or baled for the purpose.

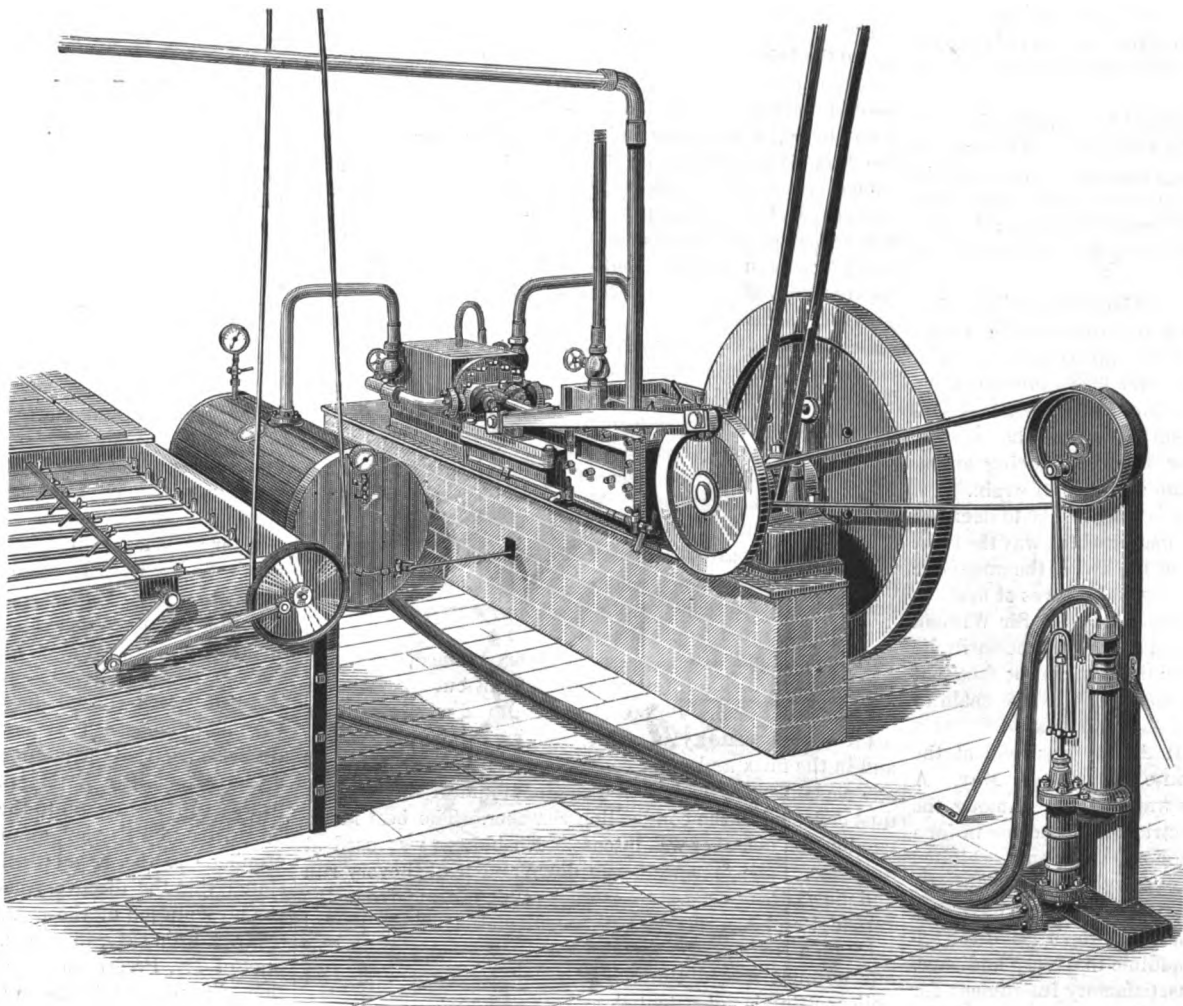
An improved Oil Well Torpedo, invented by Mr. W. Haus, of Church P. O., Pa., consists of an interior exploding shell and an exterior case filled with a sawdust or paper mixture. The object is to furnish means for exploding the torpedo in case the regular caps fail, without drawing it out of the well; and to this end a supplementary exploder, with capped rods and a second anvil, operated by dropping a weight from above, are provided.

In a new Iron Fence the inventor, Mr. A. Zimmerer, of Nebraska City, Neb., provides the lower ends of each fence post with a screw thread corresponding with a screw hole in a metallic base plate attached to a block set firmly in the earth. Each post is notched at its upper end, and the top rails have oblong slots, so that the rails may be secured to the posts by inserting the ends through the slots and then turning the posts in their screw sockets.

Mr. J. Gallaspie, of Russellville, Ind., has patented an improved Trace Holder, constructed with a view to keeping the traces straight and preventing them from swinging about when slack. It is formed of two pieces, hinged together at their lower ends, notched upon their inner sides to allow a space for

receiving the trace, and secured to each other by a thumb-screw at the upper end of the smaller part. An eye in the upper end of the longer part receives a supporting strap, which is secured to the hip strap of the harness.

A Rainwater Filter, designed to filter the water passing from a roof to a cistern, has been patented by Messrs. W. H. Thomas and T. H. Carter, of Mount Sterling, Ky.



ETHER ICE-MAKING MACHINE.

vaseline is preferable, as there is no odor from it and it is quite as bland."

FIFTY thousand dozen of American hay rakes, says a writer in the *Sheffield Daily Telegraph*, have been ordered and partly received by a single firm in Sheffield for this season's demand only.

Freezing in winter is avoided by the automatic draining off of the water in the filter as soon as the supply from the roof ceases; but it is closed again, so as to cause the water to pass through the filtering material, as soon as water is supplied from the roof.

Interesting Electrical and Magnetic Experiments.

At a recent evening lecture at the Royal Institution, London, a discourse was delivered by Sir William Thomson, Dr. Siemens being in the chair. The subject was "The Effects of Stress on the Magnetization of Iron, Cobalt, and Nickel." Sir William first pointed out that certain magnetic bodies possessed the power of retaining magnetism in a greater degree than others, iron possessing this force in a high, and nickel and cobalt in a lesser degree; paramagnetic bodies do not possess this power.

The magnetic property in bodies might be different in different directions; that is, it varied according to the structure of the body. Some bodies could be isotropic; that is, their magnetic properties might be the same in all parts of their mass; thus, a lump of dough, when uniformly kneaded and placed between the poles of a powerful magnet, was unaffected; but when compressed in one direction, became influenced by the magnetism.

The influence of the magnetism of the earth on a bar of soft iron was next pointed out, the bar becoming magnetic when held in the line of the dipping needle, the upper end of the bar always taking the same magnetism, even when the ends were reversed, after the bar had been held in one direction.

One interesting experiment consisted in inverting a bar of iron, part of the weathercock of Oxford Cathedral, which had stood upright in the steeple for over 800 years, and had been carefully treasured by Faraday in the same position, with the same end up, ever since. It would have been a scientific sacrilege to have done so idly, but the object was to see whether, after three centuries of fixity in position, it had acquired a fixity of magnetization. No one had a better right to perform the act than the philosopher to whom Faraday has handed on the lamp, and no one could have done it with more reverence. The result could not be predicted, and it was awaited with considerable interest. Before inversion, the upper end of the bar was a true north pole by virtue of its position, and the lower end a true south pole. After inversion, the latter became a true north pole, and the former upper end a true south pole, showing that the magnetic induction of 800 years had not taken a permanent hold upon the iron.

The effect of striking a bar of iron, cobalt, or nickel, held in the line of the dipping needle, was shown to give a very perceptible amount of magnetism to them, even when the blows were very slight.

It was pointed out that this effect was very much more considerable in long than in short bars, and that therefore it was advisable to avoid the use of such bars, long in proportion to their breadth, for stanchions in ships, as compass errors might become considerable from the magnetism which such bars might acquire.

Villari's discovery was next alluded to, namely, that the effect of stretching a magnetized wire was to increase its magnetism, this increase reaching a maximum at a certain point, and then decreasing as the strain was still further increased. On the relaxation of the strain the magnetic condition of the wire was nearly, but not quite, restored to its normal power.

Sir William had extended these experiments by determining the effect of transverse strains such as is produced by applying hydraulic pressure in an iron tube; this transverse strain was found to decrease the magnetic force in the tube when the magnetic power was feeble, a maximum being reached at a certain strain; when the magnetism was strong the opposite effect was produced, a transverse strain producing an increased effect, rising to a maximum at a certain strain.

The effect of torsion on a wire was found to be to decrease the magnetic power in a wire, no matter which way the twist was made; but on the relaxation of the twist, the magnetic power remaining in the wire was less than it was at first.

In conclusion, says the *Telegraphic Journal*, Sir William said that the values of the discoveries did not necessarily lie in their immediate practical application, but in the fact that every new law brought to light added a link to the chain of human knowledge, and must be a gain to mankind.

The Annual Soirée of the Royal Society was held at the society's rooms in Burlington House on the 1st of May. A large and distinguished company was present. Among the objects exhibited, those of an electrical nature came in for a fair share of notice. The Telephone Company exhibited various forms of apparatus; the "telephone harp," of Mr. F. A. Gower, being the most prominent instrument. This invention enables some of the sonorous properties of the telephone to be rendered perfectly audible to a large audience. The telephone being a most unsatisfactory instrument for audible demonstration to a large audience, the harp of Mr. Gower will prove very useful for keeping up the interest of lectures on the subject.

Mr. Henry Edmunds exhibited his method of showing variations in the pitch of sonorous vibrations by means of a revolving vacuum tube.

Mr. Robert Sabine exhibited his discovery of the effect of light on selenium in generating an electro-motive force.

Mr. Ladd exhibited a large Holtz electrical machine, and specimens of Byrne's American pneumatic battery, lately illustrated in the *SCIENTIFIC AMERICAN*.

Messrs. Siemens Bros. exhibited one of their dynamo-electric machines capable of giving an electric light equal to 1,200 normal sperm candles; an electric lamp was also shown by the same firm.

Among the other scientific apparatus, the Edison "phonograph" was shown in action by Mr. Stroh, and explained in a short lecture by Mr. W. H. Preece.

The "mechanical chameleon," the invention of Mr. A. B. Kempe, excited much interest among the more scientific portion of the visitors. This ingenious apparatus, by mechanical means, enables all the gradations of tint of any two colors to be obtained and to be varied at will, the one tint dissolving gradually or suddenly into any other, or remaining stationary if required.

Mr. Francis Galton, F.R.S., exhibited a curious optical instrument, by which portraits of different persons could be combined so as to form a new face possessing the characteristics of each individual portrait.

Mr. Nathaniel Holmes showed in action his flashing light signal apparatus, in which a brilliant "flare" is produced by the action of water dropping on phosphuret of lime.

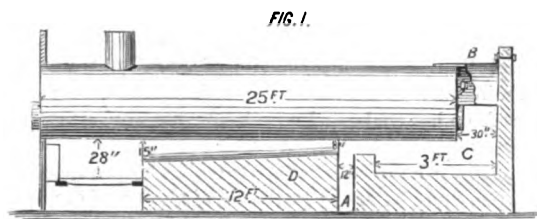
Communications.

Setting Boilers.

To the Editor of the *Scientific American*:

Some years since I took charge of a sugar plantation on the Spanish Main, S. A. Four hundred tons of coal (when it could be procured) and about three hundred cords of wood were consumed every season. I had not time to make any changes the first season, but although the average was increased I decreased the coal bill eighty tons and the wood bill one hundred cords. The second year I made the changes below described in boiler settings, and consumed two hundred tons of coal and one hundred and forty cords of wood. I burned all the bagass.

The boilers were three in number, twenty-five feet between



heads, four feet diameter, each containing two twelve-inch flues. The old settings were of tiles and stone, sixteen square feet of grate surface for each one, and were in independent settings. There were two bridge walls straight across, one at the back end of the grates, the other at the back end of the boiler. The boiler was eighteen inches above the bridge walls. The space between the bridge walls was about four feet deep and vacant. The alteration consisted in making a bridge wall twelve feet wide on a circle with the boiler, the front end fifteen inches therefrom, and the back end eight inches below the boiler, like part of a conical tube, shown at D, Fig. 1. Back of this wall a straight wall was placed, between which and the former was left a space 12 inches wide, and on each side of which was placed a door with a register, A, of four square inches, for the admission of air. Back of the last wall was constructed the combustion chamber, C. B is a bonnet of boiler iron; P, Fig. 2, cast iron plates. The masonry was not in contact with the boilers.

The grate surface was increased for each boiler from sixteen to 20.5 square feet by putting in bars five feet long in place of four foot bars taken out. My method of firing was as follows: Our coal was usually about one third slack. Coarse coal sufficient to make a good fire was separated from the dust with rakes, and after a good fire was obtained, bagass or wood was thrown on, followed by a light but frequent firing of slack coal. Before the alterations were made we made a great quantity of ashes, lodging under the boilers and in the flues and front bonnet. After this no ashes of any account were made, but a small amount of fine whitish dust collected in the combustion chamber. The heat in the combustion chamber was intense. No blower was used at any time. The fires were run down and hauled every run and new fires made. Everything which came from the furnaces and ash pits was screened, and whatever passed through a No. 8 screen was thrown away. No coal dust of any account passed through the grates. This method of boiler setting is not patented, as far as I know.

Bangor, Me.

FRANK B. CORT.

Driving Piles in Sand.

To the Editor of the *Scientific American*:

Referring to the communication of F. L. James, M.D., in the *SCIENTIFIC AMERICAN* of June 1, 1878, page 340, permit me to give my experience.

Some 30 years ago I made a contract with the United States Government to build a granite basin at the Pensacola navy yard, which required the driving of about 8,000 piles,

to the depth of from 30 to 40 feet, in the hard, sharp sand at that yard.

After signing my contract, I was informed by the then Chief Engineer of the Navy Department that a corps of engineers had tried the experiment of driving piles at that yard, and that the maximum depth to which they could possibly be driven was 15 feet; at that depth the heads of the piles were boomed up, though banded with iron hoops, and that the hammer rebounded without moving the pile.

I inquired how heavy a hammer had been used, and was informed that it weighed 1 ton; it struck me at once that it was like trying to drive a 6 inch spike with a tack hammer instead of using an 8 lb. maul.

I obtained hammers weighing two tons and a half, and allowed them to fall but 12 feet: the result was that I drove my 3,000 piles without banding the heads, the effect of the blow being to polish the heads of the piles.

If you will publish the above it will be of more benefit to the practical mechanic than the long article on the same subject illustrated by letters, figures, and hieroglyphics which I recently saw in a scientific magazine.

New York, May 28.

JOHN S. GILBERT.

HUGHES' MICROPHONE AN ALLEGED PIRACY.

Mr. Thomas A. Edison sends us a communication in which he points out in some detail that Professor Hughes' microphone is a piracy on his carbon telephone, which, it will be remembered, is based on the great changes of resistance to the electrical current which occur in carbon under minute pressures. We illustrated both of these inventions in our issue of June 8, 1878, and at the same time pointed out the close similarity between them. Mr. Edison states that Hughes' discovery is not merely identical with his, but that the correspondence continues down to the minutiae which many who concede the similarity of the investigations in other respects believe to constitute a distinctive feature in favor of Hughes. Mr. Edison says that "the subdivision of carbon has been repeatedly tested by me in my experiments on the telephone," and that he has employed the metallization of the carbon by plunging it in mercury for many years past. The change of electrical resistance with enormous rapidity by plumbago under pressure was published, as we have previously stated, in this journal on July 28, 1877, and we have already pointed out a fact dwelt upon by Mr. Edison in his present letter, namely, that Edison some time since abolished the vibrating plate in the carbon telephone, substituting a solid plate, and thus removing the last possible distinctive difference between the completed form of his device and the same form of the pirated microphone of Hughes.

It is not necessary to dwell on these points, because they are very few and simple, and the reader can review them by turning back to the illustrated description, above referred to, of the devices of both Hughes and Edison. The more interesting part of Mr. Edison's letter is its conclusion, wherein he implicates Mr. William H. Preece, the coadjutor of Professor Hughes, in introducing the microphone.

Mr. Preece is electrician to the London Post Office, the author of several works on electrical subjects, and an expert of considerable ability in that line. In the early part of last year, Mr. Edison states in the letter before us, he came to this country and visited Mr. Edison at his laboratory. With that freedom which is characteristic of the man, Edison exhibited to him the experiments which he had under way, including those involving the carbon telephone. At Preece's expressed desire Edison made him his agent for the presentation of this telephone in England. Subsequently Preece was also charged with the introduction of the phonograph in that country, and thereafter Edison kept him fully advised of his advances, both by private letter and by mailing him published accounts. Among other journals sent to Preece was a copy of the *Washington Star*, of April 19 last, containing an account of Edison's modification of the carbon for measuring minute degrees of heat; and that this was received by Preece before the presentation of the microphone to the Royal Society is amply proved by the fact that that gentleman embodied an extract from the account in an address delivered, in May, before the London Society of Arts. This extreme sensitiveness to heat, it will be remembered, is claimed to be a special discovery of Hughes in relation to the microphone. It is somewhat remarkable besides, in view of the above, that the announcement of Hughes' observation of the capabilities of the microphone as a thermometer appears as an addendum to the *Engineer's* publication of the paper, read by Huxley, announcing the invention of the microphone to the Royal Society, and that our cotemporary stated that the discovery had been made by Hughes since the presentation of the communication by Huxley.

Mr. Edison says, in conclusion, that he considers the conduct of Mr. Preece, in this matter, "as not merely a violation of my own rights as an inventor, but as a gross infringement of the confidence obtained under the guise of friendship." Mr. Hughes' part, under this aspect of affairs, is in explicable, and responses from both him and Mr. Preece, in answer to these charges, will be awaited with interest.

THE DIRECT CABLE DUPLEXED.—Dr. Muirhead has just successfully applied the duplex system to the direct cable between Torbay and Ireland. the longest line yet duplexed. Trial tests show an actual speed in working commercial messages of from seventeen to twenty words a minute, thereby doubling the capacity of the cable.

THE TRICHINÆ IN SHAD.

BY JOHN MICHELS.

A mischievous report has been recently circulated by the public press, stating that shad of the present season were infested with trichinæ, one of the most disgusting and dangerous forms of human parasites.

Although the rumor was absurd and appeared to require no contradiction, those in the trade stated that the public were alarmed and the trade much affected. Thinking that a specific statement would be welcome, I made an investigation into the merits of the case, to discover what had given rise to this libel on a wholesome and delicious fish.

Fish in the New York market were carefully examined and large quantities of the offal searched; this was followed by a microscopical examination for more minute organisms. The same work was continued on the schooners, and both masters and men closely questioned on the subject.

The result showed the shad to be perfectly healthy, and free from any form of life that need cause any alarm. The key of the mystery is probably as follows: I found most fish, both large and small, troubled with a thread-like worm, in length about three quarters of an inch. They were met with in the gills and intestines of the large red snapper from the far South, and in small fish from the Bay of New York.

Having secured various specimens of these worms, they were prepared and mounted in the usual manner. Trichinæ are not visible to the ordinary vision, the cyst in which they lie coiled being 1-50 of an inch. So clearly these worms, three quarters of an inch long, were not trichinæ.

What were they? I should describe them as belonging to the order of free *Nematodea*, called *Anguillula*, which are found almost everywhere, and abound in surface mud of rivers, aquatic plants, etc., etc.

The marine species are considered perfectly harmless, and die shortly after desiccation. They probably enter the fish with the food, and are thus met with in the intestines and about the gills. Of course they are all removed when the fish are gutted and cleaned, and would be powerless for evil if they remained.

The *Nematoid* group is divided into two groups, the first including such formidable and well known human parasites as the celebrated trichina, the Guinea worm, and the *Ascaris lumbricoides*, and a host of more or less note; and secondly, of a class still more numerous, which are not parasitic at any period of their life, and lead a free existence. The worms recently observed by me belong to the second class, and never become encysted, and therefore can never be mistaken for trichinæ. Much interest is attached to the family of *Anguillulidæ*, which is known to include over 180 varieties; and numerous workers are in the field, among whom we may name Dr. Cobbold, of England, and our own Professor Leidy.

In regard to trichinæ, I may mention the fact that M. Colin confirmed the observations of Fuchs and Pagenstecher, that it is only in mammals that the trichinæ are enabled to pass into the muscular system and remain imbedded there, preserving their vitality. Such being the case, fish can always be eaten with perfect safety, so far as danger from trichinæ is concerned.

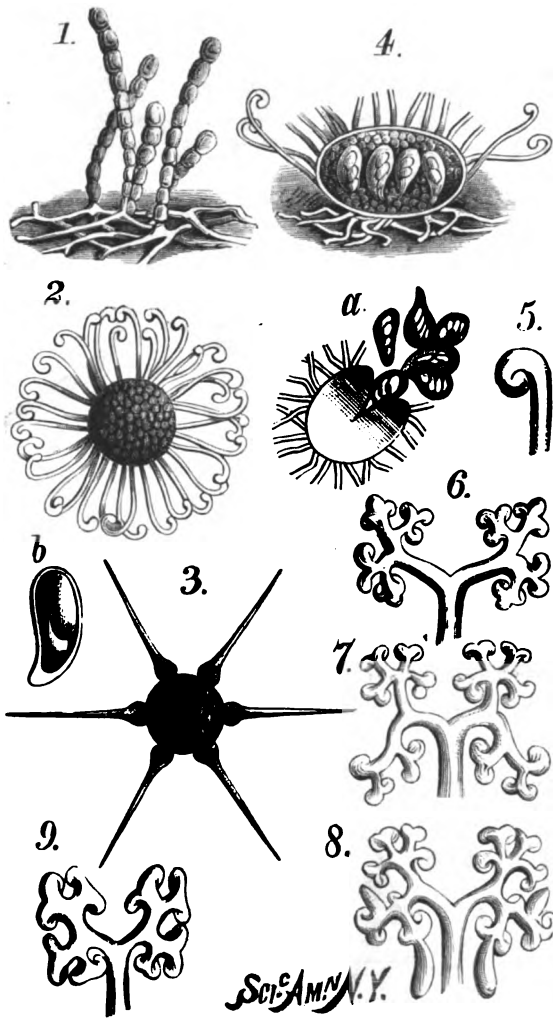
Composite Portraits.

At a recent meeting of the Anthropological Institute, London, Mr. Francis Galton, F.R.S., read a paper "On Composite Portraits, made by combining those of various Persons into a single Resultant Figure." The author remarked that when images of many different persons are successively thrown for a short time on the same portion of a sensitive photographic plate, the composite figure that results is found to have an unexpectedly good definition. No person who saw one of these composites for the first time would doubt its being the likeness of a real person, whereas it is no such thing; it represents the average of many. Of course the component images must all be in the same attitude and of the same size, but exactitude in these respects is unnecessary. The important requisite is that the images should be carefully superimposed, and this is a very easy matter to effect. The author begins by collecting photographs of persons of the same general type of features and taken in the same attitudes. These are reduced photographically to the same size. Then they are severally adjusted under fixed cross wires until one wire cuts the pupils of the eyes and the other bisects the interval between them. Then a hinged arm, carrying two points, is pressed down and pricks two register marks. When all the portraits have been thus prepared they are hung one in front of the other on two pins sticking out of a screen in front of the camera and passing through their register holes. They are photographed successively by removing one after the other to the last. Suppose there are ten component portraits, and that it would require 100 seconds exposure to get a satisfactory image of any one of them, then each of the ten portraits is exposed ten seconds only. The composite retains what is common to all the components, while individual peculiarities have in it no perceptible trace; the result is a handsome and regular face. Many specimens were exhibited. Even two faces will often make a fair combination, but the larger the number the better, if they all have the same general cast of features. The uses of the process are to procure anthropological types, to compare the average likeness of a family of brothers and sisters with that of their near ancestry—namely, two parents, four grandparents, and the uncles and aunts on both sides; and to obtain a good likeness of the same per-

son by averaging many portraits. The author exhibited methods of optically combining portraits. A stereoscope will do this in some sense, but the best instrument for the purpose is a "double image prism" of Iceland spar.

MICROSCOPY.

The Erysiphe or "Blights."—Those who are accustomed to go about with their eyes open, and are observant of the commoner things in nature—and we by no means wish to include in this class the recent purchasers of "alligator wood"—can scarcely fail to observe here and there by the wayside, in June, clumps of grass which have the appearance of being covered with a hoar frost. Let some of these specimens be carried carefully home and examined under a low power of the microscope, and the observer will be amply repaid for his trouble. The apparently chalky dust will reveal itself under the form of a forest of vegetable crystallization; "little bundles of delicate threads, clear and crystalline, composed of numerous roundish or spherical cells attached to each other in a bead-like manner," will be seen seated on a network of slender branching filaments called collectively a *mycelium* (Fig 1). This curious and interesting object is the primary stage of a minute parasitic plant belonging to the large and widely disseminated order of cryptogams, the *Fungi*. A mould which has for many years caused great havoc



PLANT BLIGHTS OR MOULDS.

1. Grass mould (*Oidium*). 2. Willow blight, magnified 80 diameters. 3. Hazel blight, 80 diameters. 4. Section of willow blight, highly magnified. 5. Tip of appendage of willow blight, magnified 500 times. 6. Tip of viburnum blight, 500 times. 7. Tip of chestnut blight, 500 times. 8. Tip of honeysuckle blight, 500 times. 9. Tip of guelder rose blight, 500 times. a. Sporangia escaping from a ruptured conceptacle. b. Sporangium of No. 3, with the two spores, magnified 160 diameters.

among the grape vines of Europe is just another such incomplete fungus, called *Oidium tuckeri*. The leaves of nearly every lilac bush will be observed in midsummer to be covered with irregular patches of a whitish substance that might, to the casual observer, suggest a coating of dust derived from the road. If one of the leaves be examined at this stage with a powerful lens this apparent dust will be found to consist of delicate cobweb-like threads, branching and interlacing in every direction. Later in the season another examination will reveal, seated on these filaments, numerous little spherical objects, some exceedingly minute and white, others a trifle larger and yellow, and others again brown. The white and yellow bodies are the young, and the dark brown ones the mature fruit of one of these fungi. These interlacing, delicate filaments (called a *mycelium*), along with their fruit, constitute what is popularly known as a "white mildew," "white mould," or "blight;" and such a one as we have described, in company with a host of similar forms, infesting various plants, go to make up the group known to botanists as the *Erysiphe*.

These little parasites are of melancholy interest to the horticulturist and gardener, to whom they often prove great pests. For most of them grow on living leaves and fruits, and are very destructive, either by "directly diverting the nutritive juices from their proper office and appropriating them to their own use, or by blocking up the *stomata* of the leaves and impeding the free action of the rays of light and of the surrounding atmosphere."

Professor C. E. Bessey, of the Iowa Agricultural College,

has recently sent us a paper, with the title which heads this article, in which he has endeavored to collect the scattered literature of the subject, and to give "an enumeration and description of the species known" to occur in America, "and which have been catalogued; with descriptions of all the species." This paper will undoubtedly prove of great service to those beginning the study of the fungi, and who find it difficult to obtain the necessary publications on the subject. Our own experience, however, is that it is very unsafe to rely on descriptions alone for the identification of these microscopic plants, authentic specimens being necessary for comparison. And this is made the more necessary from the fact that more than one species frequently establishes itself on the same host.

But to return to our subject: If one of the brown spherical bodies be placed in a drop of water, under a thin cover, and examined with a high power of the microscope, there will be seen to escape from it, on rupturing its membranous walls by a slight pressure on the cover (a), several pyriform, transparent sacs, in which are inclosed a definite number of spores, which vary in different species. The arrangement of these spore cases (*sporangia*) in the interior of the conceptacles is shown in a vertical section at Fig. 4. The number of spore cases (b) contained in each of these brown conceptacles varies, according to the genera and species, from one to twenty, or more. The remarkable feature about these little plants, however—that which is calculated to give them an interest outside of any scientific consideration—is the beauty of their ornamentation, which renders them desirable objects for mounting and preservation in the cabinet of every microscopist. Surrounding each conceptacle may be seen, radiating from every side, numerous (usually colorless) appendages. In the genus *Erysiphe*, from which the group takes its name, these appendages are long and floccose; in another genus they are only six or eight in number, and short and needle-shaped, from a bulbous base (Fig. 3); in another they are hooked or curled at their apices (Figs. 2 and 5); in another, again, they are long and once or twice forked; and finally in one genus, *Microsphaeria*, the tips of the appendages assume in their ramifications the most exquisite and varied forms. It is almost impossible to do justice to these elegant objects with the pencil, and their marvelous beauty and symmetry can only be appreciated by viewing them under the microscope. We have endeavored to give an idea of their general form in the annexed figures, 6, 7, 8, and 9. There is a wide field for study and investigation in the life history of these little plants, which might well be undertaken by some of our microscopists who have good instruments and no definite work in hand. The Rev. M. J. Berkeley has already described and figured (*Transactions Horticultural Society*, vol. ix., p. 68) five different forms of fruit which are produced during the course of the development of the hop-blight: First, the moniliform threads on the mycelium, which we have already alluded to as *Oidium* (Fig. 1); second, large stylospores produced in sporangia; third, smaller stylospores generated in pycnidia; fourth, sporules formed in the joints of the necklace like *Oidium* stage; and fifth, the sporangia containing the spores produced in conceptacles, such as we have described, and which is the mature fruit of the fungus.

The Olive as an American Product.

The olive has been successfully grown in California and in South Carolina, though not for profit. Gen. A. C. Jones, of the Department of Agriculture, after a careful investigation of the matter, is confident that there is no good reason why olive culture should not be profitably added to the list of our industries. The forthcoming annual report of the Department contains a paper in which is given a large amount of information with regard to the soils and climates most favorable to these trees, and the inducements they offer to the cultivator. In full bearing the olive tree yields from two to three bushels of fruit, producing from fifteen to twenty pounds of oil. An acre of land properly planted should contain about one hundred trees, and grass or other crops may be cultivated between the trees to advantage. Throughout the Mediterranean region the olive is an important source of industrial wealth; and since, in many parts, the climate of our country is not unfriendly to the tree, its cultivation may prove a real and valuable addition to our resources.

Our Exports.

The value of fifteen of our principal articles of export for the year 1877 was as follows: Cotton, \$171,118,508; petroleum, \$61,789,438; bacon and ham, \$49,512,621; wheat, \$47,135,562; Indian corn, \$41,621,245; tobacco, \$32,020,214; lard, \$25,562,665; gold and silver, coin and bullion, \$42,966,085; wheat flour, \$21,603,947; lumber, \$15,041,747; cheese, \$12,700,627; wool and woolen goods, \$9,834,849; tallow, \$7,883,616; beef, \$7,503,475. It is a notable fact that petroleum, the product of a small area in an otherwise worthless region, stands second on the list. It brings to this country from abroad more gold than any other commodity except cotton. Fifteen years ago not a barrel had been exported. For ages petroleum had been known in the Old World, yet its use was comparatively insignificant until American inventors devised the means for collecting it in unlimited quantities, and a thousand other means for transporting, refining, and applying it to profitable uses. Who can tell what other natural products of incalculable value are still lying undeveloped, waiting for the genius of our inventors to call them into life and usefulness?

New Agricultural Inventions.

Mr. G. R. Pierpont, of North Haven, Conn., has invented a new Straw Cutter, or machine for cutting hay, straw, etc., for feed. It has two cutting blades, pivoted together like a pair of scissors, operated by connecting bars and a double crank, and arranged at the end of the feed box, in connection with an adjustable gauge plate and guides.

An improved Machine for Separating Garlic from Grain, recently patented by Messrs. D. Shamberger and J. Carroll, of Beckleysville, Md., consists of a revolving cylinder having teeth or cards, in combination with a pressure roller at one side and a clearing brush at the opposite side, the grain being conducted off below the pressure roller and the garlic below the clearing brush.

Mr. N. D. Edmondson, of Crown Point, Ind., has designed an improved Sulky Scraper for grading roads, lawns, etc., in which the mechanism for holding the scraper in position for collecting or discharging the load, or carrying it from place to place, is efficient and readily controlled by the driver.

A light and strong Picket Fence, patented by Mr. C. H. Phelps, of Williamsfield, Ohio, is made by combining, with the pickets, longitudinal T rails formed of two side bars riveted to the pickets, and slotted top bars secured to the side bars by keys through the pickets. The posts are braced by anchors secured to the fence by brace rods and a yoke.

A new Gate, of the class in which a person on horseback or in a wagon is enabled to open or close the gate by operating a projecting lever, has been patented by Mr. B. B. Huntington, of New Richmond, Wis. Its advantage consists in simplicity of construction and being made without pulleys or wires.

A convenient Apparatus for Steaming Feed, which is claimed to generate steam with small consumption of fuel, and to furnish dry steam for heating, etc., has been patented by Messrs. D. D. Darling, L. L. Parshall, and F. H. Wendell, of Coldwater, Mich. It consists of a furnace with a central tube and coil of pipe, connected by a top and bottom pipe, with a tank having a central downward extending pipe for supplying water, a float, and a steam exit pipe.

Mr. S. Carnes, of Jonesborough, Ga., has made an improvement in Plow Stocks, intended to give increased strength and lightness. It consists in making the standard in two parts, bolted together at their middle and lower ends, one bar passing up and bending over the plow beam and adjustable vertically upon it, while the other bar is bent rearwardly to form a brace.

Mr. H. M. Freeman, of Lathrop, Mo., is the inventor of an improved Riding Attachment for Plows, which is claimed to be so constructed that the plow may be adjusted to work at any desired depth, that the frame is kept level whether the plow is running upon a level with the wheel or below it, and that the plow may be turned upon a square corner.

An improved Bale Tie, invented by Mr. C. H. Chase, of New Orleans, La., is a strip of sheet metal having one of its ends doubled over upon itself, the same being bent on a line drawn across the strip at an angle of 45°, so that the folded end forms a right angle with the main part of the strip. The folded over portion is returned upon itself and again bent forward, forming a U-shaped loop for receiving the opposite end of the tie, which has oblong apertures for receiving the bent end.

Mr. S. Ruggles, of Three Rivers, Mass., has patented a Potato Bug Exterminator, consisting of a poison reservoir carried on the back, and having two sprinkling tubes, so as to save time by operating on two rows of plants at once. Within the reservoir is a reciprocating stirrer, which is operated by an angular lever strapped to the arm.

An improvement upon the Corn Sheller patented August 17, 1875, by Messrs. W. H. Hall and C. S. Yingst, of Tiffin, Ohio, has been made by one of the original patentees, Mr. Hall. It relates to details of construction designed to produce a better article at less cost than heretofore practicable.

Mr. Henry Cutler, of Wilbraham, Mass., is the inventor of a new Grain Drier which is claimed to effect its purpose rapidly without danger of burning the grain. It consists of a cylinder, provided with suitable feed and discharge ducts, and heated by a current of hot air. In this is a revolving hollow shaft carrying steam heated arms, which constantly stir the grain.

Mr. R. W. Hazen, of Fremont, Neb., has patented an improved Ventilator for Corn Crib, for ventilating the mass of the corn, to prevent it from spoiling, hasten the drying, and bring it quicker into marketable condition. The invention consists in slotting the floor of the crib with air passages, and by a peculiar arrangement of boards and blocks preventing leakage of any shelled corn.

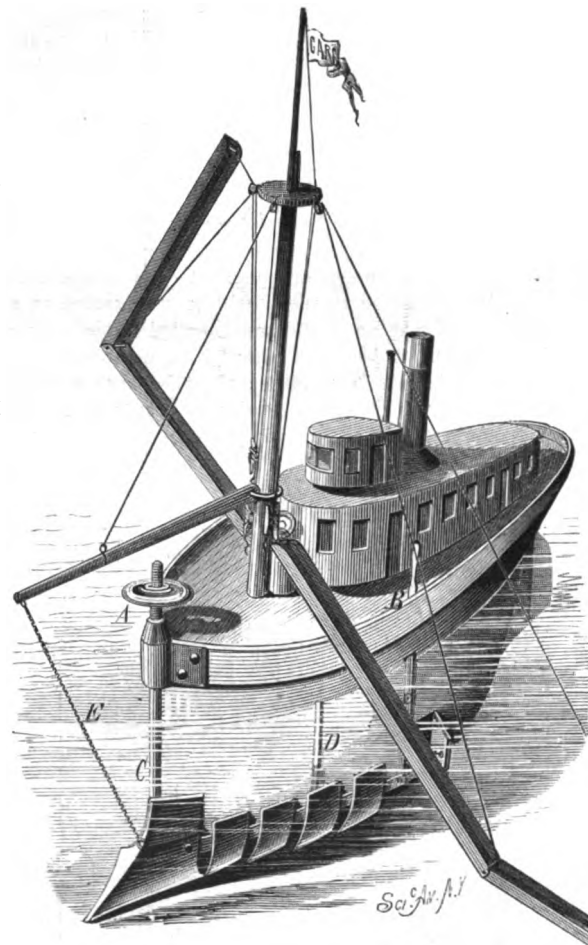
An improved Hay Press, invented by Mr. H. R. Smith, of Minnesota Lake, Minn., may be briefly described as a pressbox with a reciprocating follower, operated by suitable lever mechanism. The top and bottom of the pressbox are longitudinally slotted, the slots being wider at one end than the other, for the purpose of facilitating the passage of the hands in tying them around the bale. The follower is made of sections with enlarged heads, which leave spaces just wide enough for the passage of the bands.

A new Baling Press has been invented by Mr. J. H. Simonson, of East Norwich, N. Y. The peculiarity of construction is the means by which the power and resistance are

both applied to compressing the bale, and the automatic upward movement of the upper follower when the power is removed.

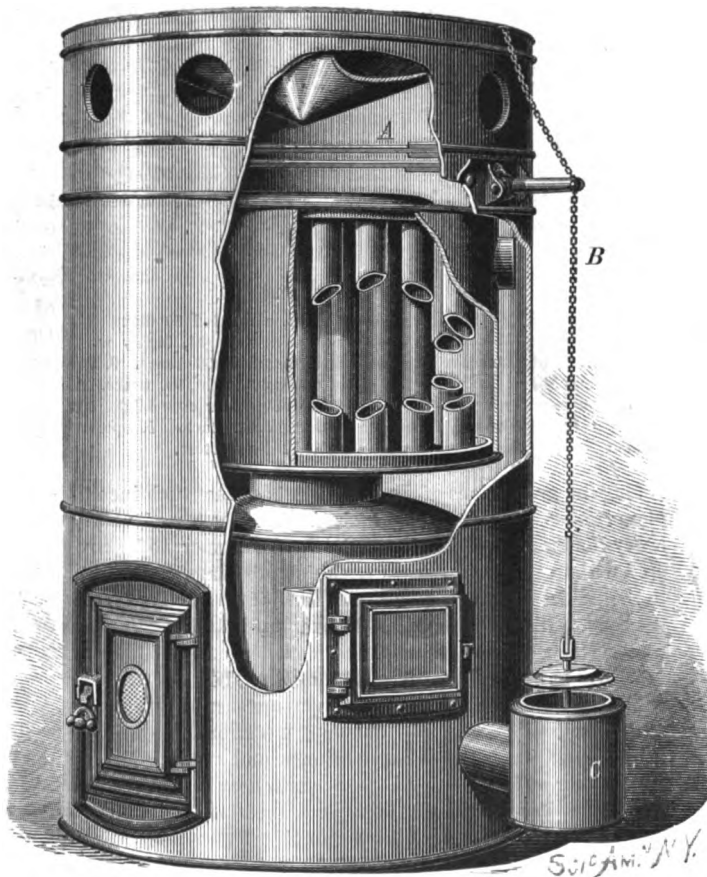
CARR'S IMPROVED DREDGER.

We illustrate herewith a new submarine excavator, designed to be attached directly to the bow and sides of a ves-

**CARR'S IMPROVED DREDGER.**

sel, and to be used for removing sand bars, submarine marshes, and other obstructions to navigation.

On the bow of the boat is an iron bar, to the lower end of which is secured a double mould-board plow. The upper end of the bar forms a screw rod, passes through a bearing, and is provided with a wheel, A. To each wing of the plow is pivoted a bar, and to these bars are attached several single mould-board plows. To the rear end of each bar is attached

**HOLCOMB'S HOT AIR FURNACE.**

a jointed lever, B, by means of which each series of plows can be raised or lowered, while all the plows can be lifted by the wheel, A. This adjustment being at the bow of the boat, if the vessel is stopped before it gets through an obstruction, the plows can be raised, and the boat backed and extricated. The plows may then be lowered again and work resumed. As the plows enter the bottom the material is loosened and swept away by the current. The front plow is firmly secured by a shield, C, and side bars, D, are provided to keep the side plows from swinging under the boat.

In case there is not enough current to remove the loosened matter, the inventor proposes to use a centrifugal pump, placed in the center of the boat, whereby the water can be raised and discharged into tank flats; or, by means of troughs on each side of the boat, can be discharged from thirty to forty feet from each side of the same, thus making a channel from sixty to eighty feet wide. When it is desired to lower the plows several feet below the boat, the chain, E, from the bowsprit relieves the increased strain on the upright plow beam.

Patented April 9, 1878. For further particulars address the inventor, Dr. Thomas B. Carr, Wilmington, N. C.

The Newton Photo-Plates.

At a recent meeting of the Photographic Section of the American Institute, in this city, examples of pictures taken by means of the emulsion or sensitized collodion of Mr. Henry J. Newton were exhibited. The author claimed that his emulsion plates were as sensitive to weak lights as any bath plates that can possibly be made; that they give all the detail in the shadows or dark places that it is possible to get by any process; that the emulsion keeps indefinitely; finally, that the Newton emulsion will do anything that can be done with the bath plate in one third of the time.

Mr. Bierstadt accepted the challenge of Mr. Newton as to bath plates, but at the same time stated that the Newton negatives there exhibited, done in eight seconds, and the prints therefrom, he had never seen excelled, if equaled, by any photographic process.

Mr. Mason, another distinguished photographer, pronounced the specimens perfect, the details in the shadows and high lights as finely rendered as any that he had ever seen.

A description of the Newton process was given several months ago in the SCIENTIFIC AMERICAN.

Adulteration of Soap.

The following receipt is extracted by *Dingler's Pol. Journal* from the *New Soap Boiler's Journal* (*Neue Seifensiederzeitung*): "Saponify 600 kilos. cotton seed oil, 200 kilos. tallow, and 200 kilos. bone oil, with potash lye at 18° in the usual manner. A thick mixture is then made of solution of potash, potato flour, and soluble silicate of soda, and two parts of soap are crutched thoroughly up with one part of this mixture, boiled, and mixed with more soda lye till the total weight rises to more than double that of the fatty matter originally present." *Dingler's Journal* remarks that when trade organs thus openly recommend sophistication caution is needful on the part of purchasers.

IMPROVED HOT AIR FURNACE.

We illustrate in the accompanying engraving an improved hot air furnace, the principal novelty in which is the automatic means for regulating the admission of cold air into the fire chamber. This device consists in a series of brass strips at A, connected together and aggregating a length of some fifteen feet. These are so arranged that the total movement due to their expansion is communicated to the chain, B, which passes around an arm and operates a double valve at C, in the air passage leading to the fire box. The contraction of the strips raises the valves and admits air to the furnace; their expansion due to an increase of temperature allows the valves to drop on the seats and so exclude air. It will be observed that the air is admitted at the side of the fuel, and that there is no damper in the smoke pipe. Smoke is thus caused to be consumed, and the fire is much more easily regulated.

The fire box is made of No. 16 wrought sheet iron, and is lined with specially prepared fire brick. The radiator contains 24 tubes, each 8½ inches in diameter, made of soft charcoal wrought sheet iron. The general shape of the furnace is such that the heat is diffused evenly over the inside. The conical cap on top deflects the heated air into the hot air pipes. It can easily be removed to afford access to the interior.

Patented April 16, 1878. For further particulars address the inventor, Mr. Henry Holcomb, Painesville, Lake Co., Ohio.

Live Hogs for England.

A number of butchers and provision dealers in Liverpool, England, have clubbed together for an experimental importation of live hogs from this country. They have purchased a steamer and had her fitted for the accommodation of 2,500 hogs between decks, besides a large number of cattle on the main deck. If the venture turns out well they propose to establish a full line of steamers for this business. Facilities have been provided for killing and dressing the hogs on board in case of necessity.

Six Years' Progress in Making Steel Rails.

The manufacture of steel rails was begun in this country in 1872. During that year 94,000 tons were made; in 1873, 129,000 tons; in 1874, 145,000 tons; in 1875, 300,000 tons; in 1876, 400,000 tons; in 1877, 420,000 tons. During the present year the product is expected to reach as many as 500,000 tons. In 1872 the average price of a ton of Bessemer steel rails was \$115. Now the average value is about \$42. Owing

to recent improvements in machinery it is expected that the cost of production will be reduced to such an extent as to enable America to compete successfully with England in neutral markets. Inquiries begin to come in from South America, and there is a fair prospect that in a few years the exportation of steel rails will become possible.

BIRDS OF PARADISE.

The Zoölogical Society, of London, have just made an important addition to their attractive collection in the shape of two male examples of the lesser Bird of Paradise in full plumage, for an illustration of which we are indebted to the *Illustrated London News*.

The lesser Bird of Paradise (so called from its being somewhat smaller in size, though not inferior in beauty to the greater Bird of Paradise, *Paradisea apoda* of naturalists) is very abundant in certain parts of the northern peninsula of New Guinea, and is also found in the adjacent islands of Mysol and Salawatty. It lives in bands in the vast forests, feeding principally on mucilaginous fruits of various fig trees, but occasionally devouring grasshoppers, locusts, and other insects. The splendid plumes, so well known under the name of Paradise Birds' feathers, are only developed by the adult male birds, the females and young males being comparatively insignificant in appearance. These specimens are very rare, only two examples of the same species having been previously conveyed to England.

Silk Culture in America.

In January, 1876, Mr. Samuel Lowery, principal of an industrial school for colored people, at Huntsville, Ala., started the culture of silkworms in that State by procuring 500 eggs. Only 200 proved fruitful; but from the cocoons spun by them about fifteen spools of silk thread were made by a rude hand process. The thread was exhibited at the Huntsville Fair, and attracted considerable attention. In 1876, Mr. Lowery hatched 500 worms, from which he got silk enough for twenty spools of thread. Last year the crop numbered 100,000 worms. Fed on white mulberry trees, the worms did well, and thus far no symptoms of disease have been noticed. It is now proposed to plant twenty acres with mulberry cuttings, which, in the course of a year, will furnish food for two or three million worms.

The new industry is thought to be very promising for the colored population of the South. Suitable land can be had for from \$4 to \$20 an acre, and farms of twenty acres or less will furnish employment and support for a family. In France the silk culture is almost wholly carried on by small farmers, and in Alabama the cultivators have the advantage of being able to gather two harvests in a year. Raw silk is worth from \$4 to \$6 a pound, and the value of raw silk imported amounts to something like \$6,000,000 a year.

FIBRIN.—M. Setchenoff has found that the white of eggs, on being boiled in vacuum, turns solid as fibrin. In order to ascertain if the yellow of eggs has some influence on this reaction, experiments were made, and it was found that when a small quantity of the yellow is admixed, the solidification of the albumen, as mentioned above, is five times quicker. This fact, besides being a matter of great importance for physiology, allows us to obtain the albumen in a more pure form.

Test of Woody Fiber.

Dr. Wiesner recommends phloroglucin as an extraordinarily delicate reagent for woody fiber. Place a drop of a half per cent solution of phloroglucin upon a bit of pine, and moisten the spot with a drop of hydrochloric acid, and there immediately appears a beautiful lively red stain, verging upon violet. On drying, the violet tinge becomes still more marked. Even if the solution contains only one hundredth of one per cent of phloroglucin, the red color is very decided; and if there is not more than one thousandth of one per cent, the reaction can be recognized, under proper precautions. If a strip of pine is allowed to remain in such a solution for twenty-four hours, hydrochloric acid gradually draws out a perceptibly reddish satin. The slightest traces of woody substance in vegetable tissues can be readily detected in this manner. The tenderest germs, by means of this reaction, show a woodiness in the cells.

American Leather in Europe.

We have the testimony of the leading manufacturer of boots and shoes in Europe to the effect that the leather market is no longer in European hands. America regulates the price, and from being a large importer, we have turned the current, and are exporting enough to affect European production seriously. In his pamphlet, "Look out for Yourselves," addressed to Swiss manufacturers, Mr. Bally says: "European seaports have become, in part, great depots of American leather. All the Europeans interested in the manufacture of leather speak badly of this red American leather; but it is not so much because of its quality and the short time employed in tanning it (because in these respects it can bear comparison with European leather) as because of the very successful competition of this article. Certainly it is not very pleasant to be compelled to recognize the fact that a former market has become a dangerous competitor." Efforts were made as early as 1847 to find a market in England for American leather, and again twenty years later; but it was not until 1872 that an actual demand began to be felt. In the latter half of that year the export of sole leather, from the port of New York, was 811,914 sides; the next year about 660,000 sides were exported; in 1874, nearly 860,000; in 1875, over 917,000; in 1876, there were exported 1,084,522 sides; and from January to November, 1877, the number reached 863,484 sides. A little more than half the leather exported passes through New York. Last year the tanned leather shipped from Boston exceeded \$2,000,000 in value. The exports from Philadelphia, for the same period, amounted to nearly \$1,000,000.

Nearly half the leather exported goes to Germany. The English now rate American leather as unexcelled by any except their best oak-tanned. The German dealers will take nothing but the very best leather.

There is little difference in the machinery employed in the tanneries of this country and England; but owing to the high price of bark the English have resorted to chemical substitutes, and the quality of their leather has been injured. The same cause tends to decrease the annual product of Germany. France keeps out American leather by a high tariff. Denmark, Norway, and Sweden are importing it in small quantities, and there is a small but growing trade with Russia. In

addition to a considerable quantity of rough and finished upper leather, the export this year from all American ports is estimated to be likely to reach 2,000,000 sides. American leather of all kinds, with the exception of finished calf finds a ready market abroad.

The Bahama Pineapple Tree.

A large proportion of the area of the Bahama Islands is devoted to the cultivation of fruit, of which oranges and pineapples are the principal; and at the present time the fields in the estates on which the pineapples are growing form a peculiar feature in the landscape. The appearance of the broad expanse of young fruit, with its clusters of delicately tinted, but sharp and serrated leaves, rising only a short distance from the ground, and covering the undulating fields, produces a very remarkable effect. In no other branch of agriculture can so curious a picture be produced as in the growth of these vast numbers of pines. As many as a million and a half of the fruit have been collected from a single



BIRDS OF PARADISE.

Every trace of woody substance in hemp and flax can be detected by the phloroglucin. Dr. Wiesner suggests that it may be used to distinguish hemp from flax, and also as a means of dyeing fabrics woven from vegetable fibers.—*Dingler's Polytech. Jour.*

The Sugar we Use.

The United States consumes annually between six and seven hundred thousand long tons of cane sugar, less than 13 per cent of which is of home production. The leading sources of foreign supply are: Cuba, 450,000 tons; Spanish possessions, 50,000; Porto Rico, 30,000; French islands, 22,000; Brazil, 18,000; Dutch East Indies, 11,000; British West Indies, 10,000; British Guiana, 10,000; Sandwich Islands, 10,000. Twenty-one other countries supply less than as many thousand tons in all. In 1862 our home product was 191,000 tons; it fell to 5,000 tons in 1865; then slowly rose to 79,600 tons in 1871. The crop of 1876 was 77,000 tons.

acre at one crop. The appearance of these pineapple estates has as little in common with the sugar plantations or paddy-fields of the tropics as with the corn fields or vineries of Europe. In a few weeks these pineapples will be making their appearance in the English markets. They are shipped in an unripe state, and mature during the voyage, and hence are not so excellent in quality as the English hot-house fruit, or as if they were properly ripened in the ground. The pineapples of New Providence, however, are superior to any other variety, and often attain an enormous size. One, grown in Pembrokeshire, weighing $10\frac{1}{2}$ lbs., and measuring $10\frac{1}{2}$ in. in height, exclusive of stalk and crown, and 22 in. in circumference, was served up at the coronation banquet of George IV., and since then the improved modes of cultivation have greatly increased the size and quality of the fruit. There is an enormous demand for the Bahama pineapples both in Europe and America, and a new industry has lately sprung up in the island in preserving the fruit in tins when they are fully ripened; one factory in Nassau alone exports annually a million tins, valued at £16,000. These fruits are superior to those sent away earlier in the season, as they are ripened naturally and packed in perfect condition, instead of being gathered when only half ripe.—*The Colonies and India.*

New Mechanical Inventions.

An improvement in Dies for Forming Settings for rings, lockets, etc., is the subject of a patent recently issued to Mr. H. Henrich, of New York city. In the face of the lower die is a cavity of the proper size having beveled edges. A block is inserted, leaving a wedge-shaped groove between it and the bevel of the die. The blank is then forced into this groove by the impact of the top die or stamp, and a setting, having an outer beveled edge and interior square shoulder, is thus formed at one operation.

The Power Hammers commonly used in the manufacture of charcoal blooms, billets, and other iron are made in one casting, and the continual jarring often impairs the quality of the cast iron of which they are made, so that the arms break, and a new casting is required. Mr. G. M. Dillon, of Chateaugay Lake, N. Y., seeks to obviate this difficulty by making the hammer in two parts, namely, the arms which carry the breaking, drawing, and smoothing faces, and the husk or rocker into which the arms are fitted, the arms being secured by wooden wedges.

Mr. P. A. Peer, of Comstock, Mich., has made an improvement in Fan Mill Irons, which consists in using a hub or spider cast with radial loop sockets, to receive the arms of the fans, and keyed upon the driving shaft. Each arm rests against a shoulder on the hub, and is secured by a nail or screw on the inside of the socket.

In a new Washing Machine, patented by Mr. Wm. Haas, of Walla Walla, W. T., the principal features are lower stationary and upper reciprocating beaters, the latter pivoted in a way to secure a peculiar sliding motion; the division of the suds box by a slotted partition, on one side of which are the beaters and clothes, and on the other the arm and pivot of the movable beater; and the peculiar jointing of the connecting bar which operates the movable beater, allowing the latter to be raised so as to permit the clothes to be readily inserted or removed.

An ingenious Odometer, or instrument for measuring and indicating the distance traveled by a carriage, has been patented by Mr. L. C. Perkins, of Webster, Mass. It is intended for the use of liveries, where it is desirable to know the exact amount of work performed by the horses during absence from the stable, and its mechanism is prevented from being tampered with by means of a sealed cover.

Mr. Albert Demo, of Camden, N. J., has invented a novel Marine Engine, suited to a peculiar class of steamer. It is constructed so as to drive the paddles against the water with greater force than that with which they are drawn back, keeps the paddles at right angles to the line of stroke during the propelling movement, and closes them to a feather while being drawn back. Special arrangement is made to prevent jar at the ends of the stroke.

Olive Oil Soap.

The article soap appears destined to become one of the principal industrial products of the island of Corfu. The chief obstacles in the way of increased production—namely, the scarcity or dearness of the two main substances which enter into its composition—are in a fair way of being removed. The first and most costly of these ingredients, olive oil, is being produced in increasing quantities. The method employed for crushing the olives preparatory to extracting the oil is of the most primitive kind: a vertical stone cylinder of great volume and weight, attached to a shaft, is made to revolve by horse power in a slightly concave bed of the most solid construction. In this receptacle the freshly gathered olives are placed, and by the action of the revolving cylinder reduced to a pulp more or less comminuted according to the degree of pressure. The pulp is then removed and inclosed in flat circular bags of about two feet in diameter, and then subjected to the action of a strong screw press, set in motion by a lever projecting horizontally, and worked by the united efforts of several men. When under this operation, which is most laborious, the oil ceases to flow, the now strongly impressed pulp is withdrawn, and collected in heaps out of doors, where it is left to dry or ferment according to the accidents of the weather. Till recent times this refuse was occasionally employed as a manure, and partly used by the bakers for heating their ovens.

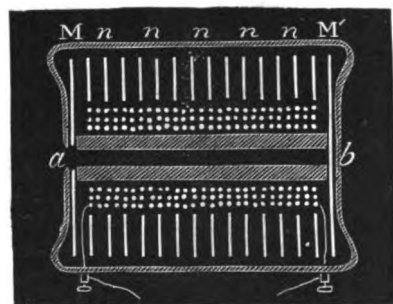
For this latter purpose it was largely exported to Malta, where it fetched remunerative prices; and this traffic continued until it was put a stop to by the imposition of an export duty by the Hellenic Government, which absorbed the whole of the profits previously obtained.

The accumulation of this material in the islands, in all of which olive oil forms one of the chief products, says the *Journal of the Society of Arts*, had become enormous, in spite of the local consumption for the purposes above stated, when it occurred to some ingenious person to subject it to a chemical analysis, with the view to turning its properties to some useful account. The result was that it was found to contain from 2 to 4 per cent of pure oil. This discovery once made, in 1869 a firm, composed of three enterprising capitalists, was established, and works on a large scale were constructed, with a view to extracting the oil. The process employed is both simple and ingenious, and has turned out a complete success. It consists in forcing, at a high temperature, bisulphide of carbon through a given quantity of the refuse, which, after being reduced to a fine powder by being passed between cast iron rollers, is inclosed in an air-tight metal cylinder of great strength, communicating with another receptacle or reservoir, also air-tight, through which the bisulphide is forced from beneath, carrying along with it the oil disengaged by its action. After a sufficient time allowed for cooling, the reservoir is opened, when the oil, now of a greenish color, but almost inodorous, is found floating on the surface of the bisulphide, whence it is bailed out and preserved in casks. The bisulphide remains unchanged in its qualities, and but slightly diminished in quantity, ready, with slender additions, for operating afresh. This substance is now known in commerce under the designation of "pyreune oil," from the Greek word signifying core, or kernel.

The second ingredient is soda, which has to be wholly imported from abroad, at a proportionately high cost. An almost unlimited supply might be obtained were the manufacture of sea salt, from which it is extracted, carried on to an extent of which it is capable. It is satisfactory to observe that a concession of the extensive salines at the western extremity of the capacious bay, which extends beyond the town and port of Corfu, has been obtained from the government on advantageous terms, by a private company, with the view of employing the produce in the manufacture of soda, for which works are in the process of erection. The soap, which is made by hand, is, for the most part, exported to Continental Greece and Turkey; as, also, a portion of it to Trieste and Venice. It is packed in deal boxes, containing 150 lbs. each. As the profits to be derived from introducing this article into the English market have not escaped the calculations of the manufacturers, it is but fair to state that the purer ingredients in its composition are occasionally adulterated by an admixture of fuller's earth, which, while it adds considerably to the weight, impairs its quality.

M. TROUVÉ'S NEW TELEPHONE IMPROVEMENTS.

M. Trouvé has recently communicated to the French Academy of Sciences an account of a new telephone which he has devised, which, while being a modification of Bell's, gives, it is stated, much better results. Its construction will be understood from the engraving herewith given. *a b* is a



tubular magnet surrounded by a coil of wire. Opposite one pole, *a*, is a circular membrane, *M*, similar to that on the ordinary telephone, except that it is pierced with a central hole, the diameter of which equals that of the aperture through the magnet. Opposite the other pole, *b*, is a diaphragm, *M'*, in which there is no orifice. If speech be uttered before the diaphragm, *M*, the sonorous waves throw it into vibration, and then, continuing, their movement through the magnet excites the diaphragm, *M'*. The magnet is thus influenced at both poles, and much more intense currents are induced in the coil. The receiving apparatus, similar to that just described, receives the corresponding currents, and its two diaphragms likewise vibrate. The ear, placed at *a*, receives the sounds, therefore, from both.

In order to compare, experimentally, the results furnished by the Bell telephone with those of the multiple telephone, sounds were received on the unperforated diaphragm of the latter alone, which, thus used, corresponds to the ordinary Bell instrument. Then the multiple telephone was turned, and on placing the ear at the opening, *a*, it was at once remarked that the intensity of the sound was doubled. The sound is still further augmented by placing between the end diaphragms a series of others, *n*, rounding the solenoid and influencing it over its entire length.

M. Trouvé has, besides, recently invented a telephone on a new principle, which is made as follows: A metallic vibrating membrane constitutes one of the poles of a high tension battery. The other pole is adjusted before the plate by a micrometer screw, which allows of varying its distance from the membrane without the two ever coming in contact. This distance, however, should never exceed that which the

battery current can pass over. If by sonorous waves the transmitting membrane is caused to vibrate, during the vibrating movement the distance between the poles, and hence the intensity of the current, will be constantly modified. These modifications determine, in the receiving apparatus, variations of magnetism corresponding to variations of intensity of the transmitting current, which cause the vibration of the receiving membrane. It will be observed that this new telephonic system is based on the resistance of the exterior current of a high tension battery, and this it would seem possible to modify within very wide limits by placing the membrane in different media, such as rarefied air or other gases, to which vapors capable of modifying the resistance might be added.

Is there a Hole through Mercury?—Are all the Planets Rings?

Mr. Richard A. Proctor, the eminent astronomer and eloquent lecturer, gives a report in one of the English papers of his personal observations of the recent transit of Mercury, made with an $8\frac{1}{2}$ inch reflector, and notes a very interesting if not remarkable discovery. He says:

"A bright spot was seen on Mercury's disk. It appeared to me perfectly central and of sensible magnitude. My eldest daughter, who observed with me, described it as a mere point, and quite central, as if the disk were a round piece of black card, and the bright spot were a hole pierced through with the compass point in striking out its circular outline. I noticed one feature in the bright spot which seemed to me decisive as to its subjective nature: when a small cloud passed over part of the sun's face, nearly the whole of which was in the field of view, the bright spot perceptibly waned in brightness, though not crossed by the cloud. This I noticed distinctly three several times. Another feature—perhaps a mere illusion—was that it seemed to me, as the spot thus waxed and waned in brightness, that it was triangular in shape. I could not distinctly recognize this peculiarity when the luster of the spot was steady. The aspect of the spot was not perceptibly modified when the telescope was released from the driving clock and Mercury allowed to approach the edge of the rather wide field of view."

We published in the *SCIENTIFIC AMERICAN* several years ago the vagaries of a backwoods philosopher to the effect that our earth had a central cavity of enormous dimensions, extending from pole to pole, through which the ocean waters ebbed and flowed; and he declared that whenever any ship could reach the north pole it might sail placidly into the aforesaid cavity and reach the bowels of the earth; where a strange race of human beings would be found living in peace and happiness; with other marvels in multitudinous numbers.

In view of Mr. Proctor's discovery, the knowledge that Saturn has planetary rings, the fact that when a milk pail is whirled like Jupiter the liquid moves outward, leaving an opening in the center, who knows but Mercury has a hole through it, and that the bright spot seen by Mr. Proctor was simply the sun shining through the aperture? If Mercury is tubular, may not the earth be also? This is one of the questions that Captain Howgate or Mr. Bennett have before them for solution in carrying forward their polar expeditions.

The Use of the Agricultural Department.

The annual attack upon the Department of Agriculture is serviceable in bringing into strong relief the advantages derived from its labors. Some points brought out in the recent discussions in Congress are worth noting. In justification of the work of distributing seeds, a member said that the seed oats sent out to the Northwest have improved that crop more than enough to pay all the expenses of the Department for the past five years. Another member said that a single package of Foltz wheat received in Kansas a few years ago had been the means of changing the entire product of a large area, giving the best article they had ever had. Similarly of sorghum, which has put millions into the pockets of the farmers of the West, said a member, "The molasses and sugar that have been produced from it will more than pay every dollar expended upon the Agricultural Department."

Our Steam Street Railways.

The New York correspondent of the *Baltimore Sun* is evidently not in love with the new system of iron railway bridges that now occupy some of our finest avenues. Speaking of the Gilbert Elevated Railway and the recent accident caused by one of the first trains, he says:

"Celebrating the event by frightening a car team on a track below into a mad runaway, the Gilbert elevated vehicles may now be considered as available for all travelers wishing to avoid death in curb shattered or post splintered conveyances of the streets. The moving, hideously clattering crest of a straddling iron monster, which has settled upon miles of once thriving thoroughfares, to suck all the business life out of them, the Gilbert cars are the sworn enemies of equine and human nerves alike, and will have what sonorous reporters call their 'holocaust' of victims before the year is out."

American Stamping Mill for Peru.

An eighty stamp mill, one of the most complete and powerful ever undertaken, is in process of construction in this city, for use at the famous Oroya silver mines of Peru. It is to be ready for shipment July 1, and will require a 1,200 ton ship for its transportation.

PLANT MIND.

VII.

THE NERVES OF PLANTS.

The distinction or "boundary line" between plants and animals or between animal and plant life is not to be found; we are inclined to believe, does not exist. The arcana of life operation and life source have been explored in all their recesses, only with this measure of successful result, to prove that "all the boundless universe is life." In organization and function, in construction and requirements, plant life is not inferior to animal life; in delicacy, sensitiveness, and beauty only a part of the sublime unity and variety which express a Creator and a God throughout the visible works of His almighty hand. Variety of expression, in conjunction with fundamental principles of organic and mental life, seems to be the point at the base to which we are led, and from which we begin again when we attempt to read the "open secrets" of creative revelation which await our intelligent and loving recognition.

Plant organization, reduced to its simplest form, is exhibited in the action of those threads, or internal *capillitium*, which, being spiral in their arrangement, conform to the fundamental law of harmony between structure and requirement, or fitness of contrivance, and by intuitive analogy, when microscopic investigation reveals the existence of channels for the conveyance of an ethereal fluid, expended in the acts of contraction and extension, in movements of approximation and fructification, in the care of offspring, evident sense of well-being or dejection; determined pursuit of light, air, and nutriment; submission and resistance—all these and more stimulate conjecture, and modern thinkers approach certainty, thus revolutionizing popular thought and every-day vision, until he "who had only eyes, now learns to see."

The presence of nerves in vegetable beings is from its very nature an obscure question, relating, as it does, pre-eminently to their internal structure, and some modern thinkers have even argued that their absence need not prove inanimation. This argument is advanced by M. Fechner, an eminent German naturalist. On the other hand, the Swedish botanist, Oken, saw nerves in the spiral fibers, and claimed the distinction of being the first botanist who admitted their purpose and office. Goethe held the same view; while our own American professor, Harlan Coultas, expands the idea of a ruling mind, operating upon and directing those subtle fluids and channels of communication, teaching most lucidly the roots, stems, leaves, buds, are parts of one individual, and each contains a link of connection with all its parts, as do muscles, bones, nerves, tissues, in the human frame. Indeed the nerves reach to the extremities of the whole vegetable body, and are the channels of communication with the sensorium, brain, or controlling force. The principle of unity is found to be complete, and, once fully recognized, we are easily led to believe it possible that even plant life may be capable of thought, adapted to the necessities and felicities of its plant individuality.

The first regular form seen by the unassisted vision, in the inner surface of the cell, is the spiral, and all subsequent additions assume this form, and can be resolved into it as their normal type. The *Trypneas*, to be found in the pools and streams of India, and as high as 15,000 feet among the Himalayas, in the ice cold springs trickling from the edges of glaciers, are among the largest among the *Conferve*, and have filaments as rigid and thick as horsehair. Under the microscope these filaments are seen to be joined by transverse tubes parallel to each other, and marked by articulations longer than broad. In their internal granular matter they exhibit the spiral arrangement, in some cases resembling repetitions of the Roman numeral X, and in others a series of the letter V; the spiral rings after conjugating producing a dark colored globule in one of the filaments.

Voluntary motion in one of its simplest forms is also exhibited in the class of *Conferve* called *Oscillatorie*, which grow in masses of filaments based on a mucilaginous substance. Their filaments are elastic, simple, minute, and mathematically straight; distinguished by close parallel rings easily separating from each other. They oscillate to the right and left, and travel in a few hours to the distance of ten times their own length from the stratum. Many species have at their extremities a tuft of minute delicate *cilia* or hairs, which are constantly in motion. Three or four days constitute the average of their cycle of life. Dead filaments form the bases of living ones, and this peculiarity connects them with the coral zoophytes, although there seems to be no necessity for supplying links between vegetable and animal life, but rather to recognize the simple universality of boundless life itself.

The functions of fructification and reproduction especially require a nervous apparatus of extreme delicacy and sensitive obedience to the controlling force of animation, and we find organisms in the hitherto much unexplored kingdoms of lichens, which bring abundant evidence in support of this statement. The cylindrical filaments which surround the cellules, and, we believe, invariably connected with them, form a beautiful network of meshes, and may be seen beautifully illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 126. In the approximation of filaments the sensations of need and supply are expressed and satisfied. Corresponding processes are thrown out, forming a transverse tube of communication, through which the endochrome of one can pass into the other, forming the round mass which becomes seeds or spores for reproduction of new beings.

The River *Semania* (*Semania fluviatilis*) has elastic, rigid, and bristly filaments, knotted at equal distances with swell-

ing joints, springing from a cartilaginous disk, by which it is firmly held against the force and weight of strong currents and Alpine cascades. The sporules within the fronds break with great force through the tough knots at the joints, and Borg relates that these filaments have a movement of retraction which can be felt by the fingers which hold them.

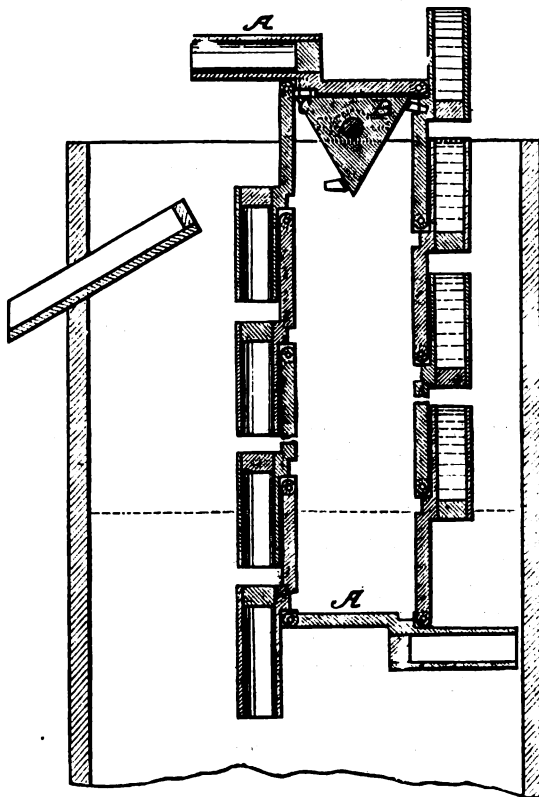
Conferve are found in single branchless filaments, forming a loose, fleecy stratum, as well as aggregated together in singular forms. The filaments of the *Hydrodictyon utriculatum*, or water flannel, form a tubular purse or net, with regular polygonal meshes, sometimes slender as a horsehair and sometimes so coarse as to feel harsh to the touch. Each articulation gives birth to new filaments, which add new meshes to the net. It is of very common occurrence in ponds and ditches in the middle and south of England.

The researches of those who have sought the infinitely great in the infinitely little have discovered the existence of nervous filaments in even the fungi or embryonic or imperfectly developed organisms. Here are to be seen colored articulated filaments, forming a kind of fibrous crust, sprinkled over with loose granules, supposed to be the fructification. One curious species is found on windows and damp glass in shady places, and, if we mistake not, such a specimen is to be seen in one of the cases of our own New York Aquarium, having been found upon a pane of glass which came from Europe, and was permitted to remain undisturbed. The tendency to vegetate, therefore, would appear universally expressing itself in connection with cells and filaments, in the smallest and simplest organized object which performs the natural operation of multiplying itself; as well as in the larger and more complicated human form. Indeed, simplicity of organization reveals a wonderful persistency of vital principle, producing vast and dense masses, with an extraordinary rapidity of development, alike marvelous and beautiful. The only way to gain an insight into the mysteries of vegetable physiology is the close observation of the hitherto neglected department of botanical studies, the class of plants which are superficially supposed not entitled to even a place in the vegetable kingdom at all.

R. C. K.

A NOVEL CHAIN PUMP.

Mr. Theodore Wallis, of Scipio, N. Y., patented April 17, 1877, the improved chain pump herewith illustrated. Each link, A, is made with an offset, where is formed the lug by



WALLIS' CHAIN PUMP.

which the link is pivoted to the rear end of the next preceding link. The forward parts of the links are made cylindrical and hollow, to serve as buckets for raising the water. The endless chain passes around a triangular wheel, the sides of which are made of the same length as the rear part of the links. To the wheel, at the rear side of each angle, is attached a fork to guide the links into place, and to prevent them from slipping off said wheel. The forks, C, enter rabbits in the links, A, at their shoulders.

With this construction, as the hollow parts of the links, A, pass over the wheel, B, as the same is revolved, the water is discharged from them, and is received in the spout, by which it is conducted into a pail, trough, or other receiver.

The Coffee We Drink.

During the twenty years ending June 30, 1876, the United States imported over 2,200,000 tons of coffee, less than 100,000 tons of which were re-exported. During the year ending June 30, 1877, we imported 320,000,000 pounds of coffee, three fourths of which came from Brazil. For the twenty years mentioned our consumption of coffee averaged 200,000,000 pounds a year. During the last five years of the period it was 300,000,000 pounds. Latterly the relative

amount brought from Brazil has declined, owing to the greater increase in the amount imported from other countries. Last year our coffee account with Brazil exceeded the sum of our exports thither by more than \$28,000,000.

How to Make a Market for Iron and Steel.

More steel converters will not insure a greater consumption of their products. The need of railroads is only to bring and carry what is produced. The greater the production the greater the population and the greater the necessities of transportation. The greater the wear of rails the greater the demand for steel. The greater the employment in varied production, the greater the demand for implements, machinery, and tools. Now the great iron and steel industry of the United States can only have continual and insured prosperity by insuring a continued profit in the pursuits demanding steel. If there were a million more plows, or reapers, or axes, or looms, or turbine water wheels, or furnaces, or sugar refineries, or ships, or cars, or carriages, or a million of any or all the heavy things in which cheap and fine iron and cheap and fine steel are used, in request, how quick would the steel pulse of the nation feel the more rapid circulation! There is, then, an opportunity for a hint to the steel men in their efforts. A good manufacturer sees to it that he has a market. There is, he knows, no use in piling up even manufactured goods. For what, then, is there a demand? In what can idle capital and idle people be employed to provide renewed demand for iron and steel? If we turn to the statistics of commerce we shall find two facts: That the United States import a large amount of the products of other nations which can at the same time be as well produced at home, doubly rewarding the nation in keeping, employing, and earning what is now paid out. Second, that other nations import large amounts of goods, a great part of which the United States should be engaged in furnishing. Commercial regulations are necessary to enable these industries to assume equal positions; but, more than that, the knowledge of how these things are produced is most necessary, that our capitalists may invest safely, and also that our inventive people may furnish the labor saving appliances.

Among the things imported are \$25,000,000 worth of flax products; and \$75,000,000 worth of sugar. Where the sugar cannot be raised from cane it can profitably from beets. The flax is an industry indigenous to the country, and only needs the careful discrimination of the knowledge of how to produce to begin it.

Were the \$100,000,000 saved among our people which has been paid out to foreign countries during the past ten years, our prosperity would be upon a better foundation. If we were sure that the country would have the employment and use of these two industries of \$100,000,000 a year, there would be a far more animated blood passing through our veins than at the present. These two industries are by no means the only ones waiting assistance, but the fact remains that the more employment for labor and capital the more consumption of productions of all kinds.

American Street Cars.

There is perhaps no better illustration of the peculiar excellence of American workmanship than is furnished by the American horse car, nor any better proof of the good policy of superior workmanship than the favor with which these cars are received the world over. American cars are dearer than those made in Europe, yet ours are everywhere preferred, because of their superior lightness, strength, and durability. Wherever tramways exist there they may be found, testifying to the quality of the work of our well paid artisans. The proprietor of a shop which has sent cars to Europe, Asia, South America, and the isles of the sea, says that when the first dozen of American cars were placed on the road of the Bombay Tramway Company, the same number of English cars were introduced. Six months sufficed to prove the dearer American cars to be the most economical, and since then American cars have been used exclusively. The English car is one fourth heavier than the American, giving so much more useless dead weight to carry, and ultimately gives way at the joints.

Illustrated Advertising.

A correspondent of *Land and Water* sends to that paper specimens of illustrations of American agricultural machines and implements, and says that he does not wonder that such American manufactures find a ready market in all the British colonies, and sell in preference to English goods, seeing that such fine wood-cuts are sent out wherever the English language is spoken. The editor of the paper advises English manufacturers to profit by the example of their rivals, and improve their wood-cuts. Possibly, while they are about it, a corresponding improvement in the quality of their goods might also be found advisable.

Our Iron Trade.

After much converse with prominent iron manufacturers, a *Herald* correspondent is confident that, unless unforeseen disaster occurs, we shall soon take the lead of England in this line of manufacture. The present standing of the trade he sets down as follows: In the manufacture of pig iron we have driven England virtually out of our markets, except as to small quantities of Scotch pig iron; our merchant or bar iron is so good that we are able to export large quantities; in iron hardware we beat the world and control the foreign markets.

LETTERS FROM THE PARIS EXHIBITION.

THE REAPER AND MOWER EXHIBITS.

To the Editor of the Scientific American:

It is probable that the present Exhibition will give rise to no more determined and well sustained contest than that between the harvesters of the various exhibitors. It is understood that the English discouraged any field trials, but the Americans urged that no other test could be valuable or conclusive, and it has now, I understand, been determined upon, and some tracts of grain and grass engaged in the neighborhoods of Versailles and Vincennes on the opposite sides of Paris, and each easily reached by rail.

Nothing in the American section is so amply shown as reapers and mowers, and there are few things upon which we pride ourselves more, and none which have done us more credit. The sewing machine and the breech loading rifle are to be classed in this respect with the harvester, but not before it. In the sewing machine, we have but two exhibits in this Exhibition, the "Wheeler and Wilson" and the "American," though the "Singer" and the "Howe," built in British factories, exhibit in the English section. Sewing machines are not in force as at the Centennial, and no such imposing range of machines of this class as was exhibited in the Machinery Hall in 1876 is to be found here. About half of the machines for which space was secured in New York have not been presented here. The assortment from foreign countries also is more limited than at the Centennial. The business has evidently suffered considerably in the two years last past.

Great struggles are being made by Americans and English to secure the French market for harvesters, and also to impress the representatives of foreign nations in Paris. The Americans are decidedly ahead at present, and if they could keep all they have invented they would be still more so, but patents run out and machines are easily copied, and many American improvements are not patented in England, and so are liable to be pirated at once, and some are taken bodily without regard to right. This is not the case with all English manufacturers; far from it, for there are as fine and honorable gentlemen in that fraternity as can be found anywhere, among whom I would cite the late Mr. Hornsby, of Grant-ham, England.

Without entering just now into a close comparison between the American and English reapers, some idea of the closeness of the French copies of the American may be gained from the results of a careful examination of the whole French collection, made several times and repeated to-day.

Many French exhibitors show American and English machines, and the names "Système Wood," "Système Johnston," "Système Buckeye," are common in the French Agricultural Annex. Taking, however, those manufactured in the country, we find ten French exhibitors:

1. Liot, of Rouen.
2. Albaret, of Liancourt (Oise).
3. Limare, of Fecamp.
4. Cumming, of Orleans.
5. Hurtu, of Nancis.
6. Pinet, of Abilly.
7. Hidien, of Chartearoux.
8. Renard, of Nantes. (Mower only.)
9. Palente, of Blangy-les-Arras.
10. Laelier, of Soissons.

What I am about to state by way of comparison would to a very large extent apply to English machines also; but we will take the countries one at a time, and when we have done with them we shall have done with the subject. There is no other competition worth mentioning. No reapers are shown from Spain, Portugal, Russia, Austro-Hungary, Switzerland, Belgium, or Holland. The Canadian and Swedish are more bold-faced piracies than either of the others, and will require a word at the close.

Coming back, then, to the French, we may say first what concerns them generally, and it will be seen that as to this division of the subject they are all strictly on American models—in other words, copies of ours.

All the machines, reapers, and mowers have the cutter bar projecting into the grain, the knife with triangular sections reciprocated horizontally in slotted guards, by pitman and gear connection with the ground wheel of the carriage. One might say, "Of course they are, all reapers are;" but these are not all the possible ways of doing the work, and we have good machines in America which come outside of this description. Witness the front cut mower, for instance, which cuts right behind the team. The points cited are all American, and what I say is, that no French substitute seems to have been found.

Then, again, every one of them has a frame hinged directly to the axle of the carriage, or intermediately, to allow of the vertical adjustment of the height of cut. This is American.

Every one has a divider in the grain and a gathering board at the carriage side end of the finger bar. I do not wish to be monotonous, but these are American. So is the grain platform itself, for that matter.

Is that all? Well, not quite.

Every reaper in the French section has a set of revolving sweep rakes, controlled by the Johnston double cam and switch. Each one of them has its adjustments by means of levers, and this also is American.

A number of the machines have the complete four adjustments, namely:

For raising the cutter to regulate the height of cut.

For giving more or less pitch to the guards relatively to the ground.

For operating the switch of the rake cam.

For throwing in and out of gear with the drive wheels.

All the machines have the last mentioned, and I do not insist upon it, as there are many different ways of doing it, and some are probably novel.

Nos. 1, 3, 6, and 7 of the list of firms have all the four adjustments.

Of the other features of the machines it may be mentioned that they are all right hand cut, turning "gee," as we should say, though I own it is impossible to give an idea of the sounds which a French driver utters.

Of the reapers, Nos. 1, 3, 9, 10, are two-wheeled machines. The others (except 8, which is a mower) are single-wheeled.

Nos. 1, 2, 3, 6, 9, 10, are hind cut; Nos. 4, 5, 7, middle cut; that is, even with the main axle.

The seats are nearly all well over to the near (left) side of the machine, and in some cases the driver's perch is on a hinged frame extending away out beyond the drive wheel, and serving as a partial counterbalance. The hinged seats are in Nos. 4, 5, 7. No. 2, the "Perseverante," has a seat forward on the tongue between the horses.

No. 4 contains a dropper machine (an American invention), which has, what I also noticed among some English droppers, a second seat on the carriage for the raker. In some parts of the United States we do not consider a raker necessary with machines of this class. The slats of their droppers are about three inches wide, and with intervals between them less than their width. This may account for the need of a man to rake off. With us, the slats are narrower, and when the dropper falls the heads of the grain catch in the stubble, and the gavel drags off easily and in good order. I notice, however, one American dropper with a raker's seat and rake. Cumming's machines are much above the average of the French.

As above stated, the American machines exhibited by French agents in their section are not included in the above; so I pass by in this enumeration the *Fauchoise Wood*, and *Moissonneuse Combinée Buckeye*, merely smiling at the strangeness of the united names.

Eight automatic binders are exhibited at the Exhibition. Six of these are American, and two English. Six bind with wire and two with string. The names of the manufacturers are:

American.	English.
Walter A. Wood.	Howard.
McCormick.	Neale.
Osborne.	
Aultman.	
Wm. Anson Wood.	
Johnston.	

Of these, the last-mentioned in each list use string, the others wire. McCormick uses two wires. We are distinctly ahead of other nations in the matter of automatic binders, as we were in the matter of reapers. Of the two English binders, of which I do not propose to speak now, one is a modification of Walter A. Wood's, and is not yet in order, many of the parts being yet absent, and the other is a novelty which it will take much pains and time to develop satisfactorily. It sweeps the gavel backward on to a second and higher platform, and then sideways to the binder, saving the extra width on the left side of the machine (with a right cut); though as this is over the stubble and helps to counterbalance the weight of the platform, I do not see that this lateral extension is any drawback.

All the American machines have adopted the same means of carrying the grain from the platform to the binder. The plan is familiar to us in the Marsh harvester in which the cut grain is carried by a laterally traversing slatted apron to a second apron which carries it up an incline and discharges it on to a collecting table, from which it is taken, sheaf and sheaf about, by two men who ride upon the machine, bind the grain, and drop the sheaves overboard.

In the binding machines the grain falls in the same way on to the table, and the wire (in one case string) is passed around by a bent arm, which in some respects curiously represents that of a man. The wire comes from a spool in a concealed position below or behind the table, and is threaded along the arm and into the hand which holds the end of it. The arm is made to encircle the gavel of grain and bring the end of the wire to the "standing part," as the sailors call it, at a point close to the sheaf, but between it and the spool. The end and standing parts of the wire, being thus in juxtaposition and parallel, are twisted together five times around, and the tie is complete. A succeeding motion, generally of the sheaf, brings the wires beyond the twist against a cutter which severs them, the new end of the wire being at the time fast gripped in the hand of the arm, which makes its backward motion to allow the sheaf to escape. In Walter A. Wood's machine the sheaf is pushed off the machine by a sort of left arm which has previously aided in compression, so as to obviate the necessity of depending upon the tension of the wire for the tightness of the bind; in some other cases the bound sheaf is pushed off by the one following.

The description of the action is purposely made very general so as to be inclusive, but there are many points of detail showing great ingenuity and involving decided differences in construction. For instance, McCormick uses two spools, and the Johnston binder uses a string about the size

of wool twine, which the machine ties in a square knot; the two parts of the string are given a round turn, and the ends passed through the loop and pulled tight. The English string binder, I may here say, makes a reef-knot, which is also a perfectly secure one.

The binding machine is one of the great subjects of the day, the principal one stirring in agricultural engineering, if I may use that term to express what I feel of the admirable skill, persistence, courage, and liberality of the gentlemen who have given their lives, talent, and money to the enterprise. That they have made fortunes is a subject of congratulation on all hands; it is well for them, and an encouragement to the present and succeeding generations. It could never have happened without patents, however, and the people have gained one hundred dollars for every one made by the patentees.

Reference was made above to the anxiety of the American implement maker to secure the French trade, and some details were given as to the almost implicit copying of the American machine. A word on each of these subjects before I close.

Besides the difficulty of distance, with its increased freight, insurance, and so forth, and the added trouble of the time occupied in going back and forth (for a principal must in most cases see his agent now and then), there is another difficulty arising from the fact that we do not stand on as favorable terms as England in regard to the rates of customs duties. England and France have a reciprocity treaty, each mutually admitting the surplus of the other at low rates—English machinery for French claret and silk. It works well for them; but what is the effect on us? Take an instance, to state the matter exactly. An Adriance, Platt & Co. New Model Buckeye weighs boxed 350 kilos. (A kilogramme or 1,000 grammes, called kilo. for short, is almost exactly equal to 2½ pounds avoirdupois.) The import duty on this machine is 18 francs per 100 kilos., or 63 francs per machine. English machines are never boxed for the Continental trade, as the distance is so short, and an English mower will weigh unboxed about 400 kilos., on which duty is paid at the rate of only 6 francs per 100 kilos., or 24 francs per machine. There is thus on each machine a discriminating duty of 39 francs against the American manufacturer, besides the extra expenses owing to greater distance, and the value of the boxes with their added cost of freight.

Even under these untoward circumstances the Americans succeed in obtaining the larger part of the trade in harvesters, and are beginning to do a good work in hay-rakes, lawn-mowers, forks, and churns, as well as some other articles. How important the competition has become may be judged from the fact that one of our firms has sold the past year 50 reapers for New Zealand and has 500 engaged for that colony for next year. Another makes a special reaper which is a favorite in South Australia; another person whose acquaintance with American horse rakes began at the Centennial, has since sold 2,000 of one American pattern.

I referred in the earlier part of this letter to some specially objectionable features in the piracies upon our inventions committed by the Canadians and Swedish.

An Ontario implement maker heads his bills "Watson has it," and so I went over to see what he had. I found that he had not alone copied a machine made in the United States, but that he had actually used the irons of the machine for patterns to make castings, and had not even taken the trouble to chip off the numbers and letters, the private marks by which parts are enumerated in order to save trouble of description. The number "700" is cast on the frame, the same as the Adriance, Platt & Co. machine from which it was pirated. The number "50 A" is on the wheel, and is the mark on a wheel of the same firm but of a different sized machine. The machine has carried its ear marks to France, and the castings were recognized in the Exhibition. There is no doubt that "Watson has it," and none as to the character of the man who took it, I suppose.

A curious parallel specimen of Northern honesty is to be found in the Swedish Department. In that section is a sweep rake with the double cam of Johnston, and a frame with the same "700" on it, actually taken from a similar machine of Adriance, Platt & Co., of New York. It seems to be a favorite one from which to pilfer. The Swedish is a dropper with iron slats. The "700" is on the frame, "701" on the lid of the gear box, "702" on the foot plate, and singularly enough their own number, "455," added with paint. It has also the "50 A" on the wheel. They probably thought there was something cabalistic in the figures and feared to remove them. The inscription on the machine is "Westeras Mekanska Werkstad." So "he has it" also.

It is curious that both of the firms should concur in stealing from the same machine, should let the numbers stay on, and should send them both to Paris to exhibit in company with the original.

E. H. KNIGHT.

Paris, May 24, 1878.

WAGES IN FRANCE.—The United States Consul at Lyons reports that wages have increased in France since the Franco-German war from 20 to 25 per cent., and the cost of living has risen in about the same proportion. The rates now range from 25 cents to \$2.50 a day of ten hours for men, 20 cents to \$1 for women, and 10 to 30 cents for children. Trade is depressed.

CATALPA WOOD.

A little over half a century ago General William Henry Harrison, in an agricultural address delivered in Ohio, recommended farmers to cultivate the catalpa because of the great durability of its wood when used for fence posts, etc. He was led to give this advice from having found in an old French stockade at Vincennes, while he was Governor of the then Northwest Territory, pickets of catalpa wood which were yet perfectly sound, although they must have existed in place for more than a century. Lately this tree has become an object of a great deal of attention on the part of arboriculturists, principally on account of the testimony of Dr. Warder and Mr. E. E. Barney and a few others as to the value of its timber.

The catalpa (*Catalpa bignonioides*), although quite extensively cultivated as an ornamental tree in the Middle and Eastern States, is a native of the South and Southwest, having its northern limit in Southern Illinois and Indiana. This tree does not acquire a very large size in the streets, parks, and suburbs of our Northern cities, nor in such situations is it often shapely; but in its native Southern and Western home it is straight and handsome, and often attains a height of fifty feet, with a trunk diameter of three feet or more. The foliage consists of large, heart shaped, long petioled leaves of a peculiar shade of green, and having a silky luster. The tree blossoms in great profusion in June and July, and is then especially ornamental. The flowers, disposed in large showy panicles, are about an inch long, bell shaped, with a five lobed, wavy border, and are white, spotted internally with yellow and violet. The flowers are succeeded by slender, cylindrical, dark brown pods, often a foot long, which hang until spring. These pods are divided lengthwise into two cells, which are filled with flat seeds having cottony wings. When perfectly ripe and dry, the capsules are often used as cigars by boys (the cottony contents readily burning and producing much smoke), and are hence familiarly known as "smoking beans."

Mr. E. E. Barney, the veteran car builder of Dayton, O., has recently brought together all the facts and observations in his possession touching the economic value of this tree, and published them in pamphlet form. From this we learn that there are two marked varieties of the catalpa, one blooming two weeks earlier than the other. The blossoms of the early bloomer are larger, more profuse, and less tinged with purple; pods longer and finer; the bark dark colored and furrowed, resembling the bark of elm and locust trees of the same age. The bark of the late bloomer is laminated, comparatively smooth, and light colored. The earlier variety is of more rapid growth, and is straighter and taller, and has been found to endure a winter that killed the other. Mr. S. H. Binkley has on his farm, several miles from Dayton, a grove of six hundred catalpa trees, of the late blooming variety, planted from seeds twelve years ago. They are now from 25 to 30 feet tall and from 4 to 8 inches in diameter at the ground. They would now make twenty-five hundred fence posts. Eighteen years ago, while repairing a fence, Mr. Binkley, lacking a few stakes, trimmed up some catalpa limbs, three or four inches in diameter, and used them for stakes, thinking they might last one season. A recent examination of these stakes, which have been in the ground for eighteen years, has shown them to be perfectly sound. The valuable qualities of the tree, to sum up the evidence presented by Mr. Barney, are: Its easy and rapid growth in almost any kind of soil, freedom from the attack of insects, and the great value of its timber as regards its durability either in the earth or exposed to the air. The principal demand for the timber will be for railroad ties; for this purpose wood should be durable when exposed to the weather, and neither too soft to resist crushing weight on the rails nor too hard to hold the spikes properly. These qualities, Mr. Barney asserts, are found combined in the catalpa. In addition to its durability, catalpa possesses qualities that render it one of the very finest of woods for inside finish and cabinet work, inasmuch as it has a beautiful fine grain, of a warm yellow color, and is susceptible of a high polish.

Mr. Barney's pamphlet is published for the purpose of disseminating knowledge as to the value of the tree and to promote its cultivation. The author estimates that at present prices a plantation of catalpa will yield a return of \$25 per acre for each year of the time during which the trees occupy the ground. Mr. S. Foster, a horticulturist of Iowa, thinks that the common (or late flowering) variety cannot be depended upon north of St. Louis, while the early bloomer has endured the severest winters of the Western States without injury.

American Trade with Belgium.

Mr. Weaver, U. S. Consul, at Antwerp, reports to the Department of State that in exports to Belgium the United States rank next to Great Britain. Our direct trade with that country exceeds \$25,000,000 a year, and with more direct steam communication might be largely increased. The staple American articles having a firmly established sale in Belgium are breadstuffs, petroleum, oils, rosin, turpentine, cured meats, lard, tallow, tobacco, dye woods, copper, minerals, clays, drugs, honey, canned provisions, cotton, lumber, and, recently, fresh oysters. To maintain the trade in these productions, great care as to the quality and packing is indispensable. The imports of cotton are decreasing for want of direct communication with our cotton ports. The lumber trade might be increased were the facilities greater for discharging such cargo at Antwerp. The prices of fresh meats, eggs, butter, etc., in the Belgian markets,

seem to warrant their direct importation in refrigerator ships. Belgium being the most successful manufacturing state on the continent, the market for American manufactures there cannot be very large; still, the Consul thinks that, in addition to the usual list of agricultural and mechanical implements, household notions, sewing machines, and so on, our machine-made horseshoes and nails, school furniture, carriages, and wheelwrights' supplies, match splints, gutta percha harness mountings, wooden boottrees, lasts, and possibly tram cars, might be profitably sold. In introducing new wares the prevalent styles and taste in Belgium should be conformed to. Above all, economy must be consulted, for, unless cheaper as well as better than Flemish goods, American wares will not sell there.

FENCE ECONOMY.

Dr. Franklin B. Hough, in his recently issued "Report upon Forestry," prepared under the direction of the Commissioner of Agriculture, says that according to recent estimates the cost of the fences in the United States amounts to \$1,700,000,000, and the annual expense of maintenance is \$198,000,000, excluding interest at 6 per cent on the original cost. We confess to never having had much faith in the accuracy of big-figured statistics of this sort, for the reason in this case that we fail to see exactly how they are reached. Perhaps to take the totals representing one State would be to convey a better idea, and these are furnished by estimates made by the Maine Board of Agriculture, which fix the total length of fences in that State at between 127,000 and 181,000 miles. The first cost is reckoned at \$1 per rod, and the interest on this sum, with repairs, etc., comes to about \$6,000,000 per annum. This excludes the value of the land covered by the fence itself, which at \$30 per acre is worth \$975,990.

With some notion of the large sums invested in fences thus attained, it is not at all difficult to realize the importance of the statement quoted by the author, to the effect that "from one quarter to one eighth of the present fences of the country would be amply sufficient to keep stock within proper limits, especially since it appears that we are wasting money through a wrong appreciation of the use of fences which any one, so far as he is personally concerned, can remedy for himself.

The question is, Are we to fence to keep cattle out of fields where they are not wanted, or in fields where they are? The general rule is to do the first; but just here, Dr. Hough says, we are doing exactly wrong, and hence by simply changing our practice the way to economy is open. It is very much cheaper to fence the adjacent lots of a large field than it is to fence each lot separately. Supposing, for instance, an area of one square mile be divided into four 160 acre lots. These, if adjacent, would require 1,920 rods of fence. If separate fences were erected about each lot, then the length of fence would be 2,560 rods. Supposing the number of fields to be 64, of 10 acres each, if adjacent, 5,760 rods of fencing would be needed; separate fences would require 10,240 rods, and here there would be a saving of seven rods of fence per acre; that is at \$1 per rod, \$7 per acre, or on the entire area the neat sum of \$4,880. The difference is saved by the same subdivision fences answering for the adjacent fields.

American Carpets.

Our production of carpets is larger than that of any other country in the world. In 1875 the value of the product was \$32,376,168. In 1872 our importations of carpeting amounted to nearly \$6,000,000; in 1877 they were only \$674,611. In their report as to the character of American carpets, the Centennial judges said: "The proofs at the Exhibition of our attainments in this manufacture were observed with no little surprise. It was manifest, from the absence of rival foreign exhibitions, that in respect to the carpets of the cheaper and medium qualities, up to the two and three ply ingrain, the competition is confined to our own manufacturers. Even rival English manufacturers generally admitted that in the production of Jacquard Brussels, tapestries, and Wiltons, and narrow Axminsters, we have nothing to learn from them either in design or fabrication."

It is worth remarking in this connection that when American inventors undertook the task of devising carpet weaving machinery, the work was all done on hand looms by men. Now women and boys do all the manual labor. In 1844, a man with a helper could weave not more than seven yards of Brussels carpet in a day. Now a girl will weave fifty yards in that time.

The Influence of one Mill.

A single woolen mill in the city of Lawrence produces every week a million yards of dyed or printed cloths. It pays \$160,000 a week as wages. It employs 5,300 persons, paying them at an average rate of 95 cents a day to women and girls, and \$1.40 a day to men. It consumes 500 tons of starch, and expends \$400,000 for printing and dyeing materials every year. The wool it requires calls for the fleeces of 10,000 head of sheep. It secures food, clothing, and usually respectable savings to 5,300 persons and their dependents—not less than 10,000 souls altogether. This, with the freights paid for transportation of its materials and products, shows what one mill contributes to the wealth, power, and prosperity of the country. The woolen industry of the whole country amounts to more than \$200,000,000 a year. There are nearly a thousand woolen mills in Ohio and other Western States.

The South as a Field for Manufactures.

In a speech on the Texas Pacific Railway, Senator Lamar lately dwelt at great length on the natural advantages of the South for successful manufacturing. Every condition of soil, climate, and raw material for the development of a great industrial community are there. The South has already begun her industries of the future, and the profits that are realized from them are, in some instances, prodigious. But to develop these industries, she must have free access to the markets of the world, and be able to attract to herself the skill, and capital, and machinery, and appliances of the North. In the South land, food, raiment, and shelter are cheap, and taxation is growing every year less burdensome. In everything except capital, skill, and experience, the manufacturers of the South are on an equality with those of England, and the saving in baling, waste, and transportation gives the South great advantages. Nowhere in the world can cotton be manufactured so cheaply as on the spot where it is grown, where water power is so abundant and unfailing; and every factory set up there will help to develop the diversities of Southern agriculture. The cotton crop last year amounted to 4,700,000 bales; yet the Southern States have but a small part of their cotton lands under cultivation.

Glass Making at Pittsburg.

Pittsburg has 72 glass factories, covering an aggregate area of 200 acres. Twenty-two of these establishments are devoted exclusively to the manufacture of window glass, the remaining fifty to bottle glass, table ware, lamp chimneys, and so on. The work of some of the best of the window glass factories is considered equal to any foreign product. Fully 5,000 persons are engaged in this branch of the glass industry, and the annual product is not less than 800,000 fifty foot boxes a year. The wages now paid to first class men range from \$100 to \$130 a month. Second class men get \$65. In the making of bottle glass, from a half drachm vial to a twelve gallon carboy, American manufacturers claim to beat the best foreign products, with the exception of one particular style of wine bottle, in which Germany excels. In the manufacture of fruit jars, represented by ten factories in Pittsburg, the American article is far superior to the European. There are no plate glass factories in Pittsburg, though they have been successfully established in Indiana and Missouri. The Indiana factory is turning out as good an article as the French, and the machinery used was made at Pittsburg. As yet no cut glass worthy the name is made in Pittsburg, the art of cutting not being well understood, and the demand for this quality of glassware not being sufficient to warrant the importation of skilled and artistic labor from Europe. The moulded table ware is good and cheap, so that a considerable quantity is exported.

Work for New York City.

Referring to the effect of the opening of the Mississippi in furnishing a water way for the commerce of the interior, Senator Windom said that to meet such competition New York must no longer rely upon her present advantages. She must not only give to commerce a free harbor and a free and improved canal, but she must also exert her powerful influence for the removal of all obstructions and impediments to the movements of commerce on the lakes. Nor will this be enough. To give the Northern route its highest degree of efficiency and power, the Lakes and the Mississippi must be connected by a canal, which will make the upper Mississippi river the base line of New York's commerce, and thereby unite the two great systems of lake and river transportation.

American Workmanship.

In the course of a description of a visit to the French war vessel, the *Richelieu*, a foreign correspondent remarks that it seems impossible for one to go anywhere without some specimen of American ingenuity cropping up; accordingly, on the quarter deck of the *Richelieu* was a Gatling gun beside a mitrailleuse. It is astonishing, the correspondent adds, how tasteful Americans are in everything relating to machinery. The Gatling, beside the dull, heavy, somber French piece, looked like a bit of jewelry, its steel and brass flashing like gold and silver in the bright sunlight of the Mediterranean. And this is the more noteworthy because the French have a decided bent toward decoration, and generally make things look as well as possible.

Progress in Hard Times.

Notwithstanding the times, it is doubtful if the country ever made greater or more rapid progress in substantial wealth than during the past seven years. From a comparison of the statistics of the census of 1870 with those furnished by the Bureau of Agriculture for 1877, it appears that there were 81,000,000 more acres of land under cultivation last year than in 1870, an increase of 34 per cent. The percentage of increase in the number of corn produced was 22½; of wheat, 52; of rye, 42; of barley, 35; in tons of hay, 34; and in pounds of tobacco, 91 per cent. The live stock over the aggregate of 1870 was, horses, 44 per cent; mules, 45; cows, 26; oxen and other cattle, 29; sheep, 25½; swine, 28 per cent. The aggregate increase in the number of live animals amounted to about 25,000,000 head. The excess of the grain crop of 1877 over that of 1870 was nearly 550,000,000 bushels. Our exports for the year ending June 30, 1877, exclusive of gold and silver, amounted to \$632,980,080.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Portable and Stationary Engines; Boilers of all kinds; Cortlandt St., N. Y. Erie City Iron Works, Erie, Pa. Alcott's Turbine received the Centennial Medal.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsyth & Co., Manchester, N. H.

New Lathe Attachments, such as Gear Cutting, Tap and Spine Slotting. W. P. Hopkins, Lawrence, Mass.

Wanted.—A situation by a practical man as Manager or Foreman in a Machine Shop or general repairs of any kind. Can give references. Address W. Wathe, Woonsocket, R. I.

Removal.—Messrs. Goodnow & Wightman, makers of Small Tools, Model Engines, etc., have removed from 28 Cornhill to 176 Washington St., Boston, Mass.

I want 2d hand 48 in. Gap Lathe. O. S., Bridgeton, N. J.

Wanted.—Engagement by a practical Mechanical Draughtsman. Can design and superintend erection of Machinery. Address Charles Richards, 15 Webster St., Cleveland, O.

Band Saws, \$100; Scroll Saws, \$75; Planers, \$150; Universal Wood Workers and Hand Planers, \$150, and upwards. Bentel, Margendant & Co., Hamilton, Ohio.

For Sale.—A Set of Eccentric or Die Rolls, with Bed Plate. Housings and gearing all complete, in first class order. Henry Diaston & Sons, Front and Laurel Sts., Philadelphia, Pa.

Diamond Self Clamp Paper Cutter; Howard's Parallel Vice. Howard Iron Works, Buffalo, N. Y.

For Sale.—Canadian Patent for best Portable Forge in market. Successfully introduced in United States. Address Buffalo Forge Company, Buffalo, N. Y.

Best Steam Pipe & Boiler Covering. P. Carey, Dayton, O.

Cornice Brakes. J. M. Robinson & Co., Cincinnati, O.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Painters' Metal Graining Plates. J. J. Callow, Cleveland, O.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Boilers & Engines cheap. Lovegrove & Co., Phila., Pa.

Foot Lathes, Fret Saws, &c., 90 pp. E. Brown, Lowell, Ms.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 28d and Wood St., Phila.

Skinner Portable Engine, Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

Daniels' Planers of all sizes, both new and 2d hand. Send for circular. Steptoe & Co., 214 W. 2d St., Cin., O.

Address Star Tool Co., Providence, R. I., for Screw Cutting Engine Lathes of 13, 18, and 21 in. swing.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, \$350. Forsyth & Co., Manchester, N. H.

Zero Refrigerator, with cooler. Centennial award. Send for catalogue. A. M. Lesley, 373 Sixth Ave., N. Y.

For the best Bone Mill and Mineral Crushing Machines—five sizes, great variety of work—address Baugh & Sons, Philadelphia, Pa.

The only genuine Gels'r Self-regulating Grain Separator. Address the Gels'r Manuf. Co., Waynesboro' Franklin Co., Pa.

Safety Linen Hose. Protects factories and stores. Saves Insurance. Greene, Tweed & Co., 18 Park Place, N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N. J.

Cheap but Good. The "Roberts Engine," see cut in this paper, June 1st, 1878. Also horizontal and vertical engines and boilers. E. E. Roberts, 107 Liberty St., N. Y.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

For Shafting, Pulleys, Hangers, etc., send for price list and discount to Hilles & Jones, Wilmington, Del.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Polishing Tools and Supplies. Send for new price list. Greene, Tweed & Co., 18 Park Place, N. Y.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Bound Volumes of the Scientific American.—I have on hand bound volumes of the Scientific American, which I will sell (single or together) at \$1 each, to be sent by express. See advertisement on page 388. John Edwards, P. O. Box 736, N. Y.

Friction Clutches for heavy work. Can be run at high speeds and start gradual. Safety Elevators and Hoisting Machinery a specialty. D. Frisbie & Co., New Haven, Ct.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsyth & Co., Manchester, N. H.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

F. Lunkenheimer's Brass Goods for Engine Builders, Automatic Oil Feeders, Glass Oil Cups, Cady Shaft Oilers, etc. Address Cincinnati Brass Works.

NEW BOOKS AND PUBLICATIONS.

The Magazine of Art is a new illustrated monthly periodical, published by Cassell, Petter & Galpin, of London, Paris, and New York. It is devoted exclusively to what are known as the fine arts, in contradistinction to those pursuits which, while arts, are not included under the narrower and higher term of art. The initial number is quite up to the high standard which is aimed at; is replete with illustrations, some of the cuts being of unusual excellence; and the descriptive text and miscellaneous art notes furnish much interesting information. It is intended to draw largely upon the resources offered by the Paris Exhibition, with its great array of art treasures; and certainly the *Magazine* enters upon its career with remarkable facilities.



(1) A. P. asks how to prepare a strong solution of silver-potassium cyanide. A. Add to a solution of potassium cyanide silver nitrate solution until no further precipitation is occasioned; after settling, pour off the liquid and wash the precipitate several times with water; then dissolve it in the smallest possible quantity of a strong aqueous solution of potassium cyanide by the aid of gentle heat.

(2) A. P. R. writes: 1. I am about to put a feed water heater into the smoke arch of a boiler (ocomotive type) on a steamboat. The heater will be made of several rows of steam pipe passing backward and forward by the ends of the tubes in the smoke arch, being heated by the heat from the furnace. The water is to be forced through the pipe by a Blake steam pump. Will it work well? A. Probably you will need a blower, or some equivalent. 2. Where should the check valve be put in? A. Place it close to the boiler, with a stop valve between that and the boiler.

(3) O. H. T. asks: What liquid can be vaporized with the least expenditure of heat? A. Perhaps liquid hydrogen. The boiling points of several of the more volatile liquids are as follows: Sulphurous anhydride, 17°-6° F.; ethyl chloride, 51°-9°; methyl bromide, 55°-5°; aldehyde, 69°-4°; methyl formate, 52°-1°; ether (ethyl), 94°-8°; ethyl bromide, 105°-8°; methyl iodide, 111°-4°; carbon disulphide, 118°-5°; formic ether, 127°-7°; acetone, 133°-8°; methyl acetate, 133°-3°; bromine, 145°-4°; wood naphtha (methyl alcohol), 149°-9°; ethyl iodide, 158°-5°; acetic ether, 164°-9°; alcohol (ethyl), 178°-1°.

(4) A. O. asks: Is there any advantage in having a pair of cone pulleys turned, the one concave and the other convex on their face? A. We think not.

(5) F. S. asks: With what can the brass taps of steam boilers be varnished, to prevent tarnishing? A. Dilute alcoholic solution of shellac or sandarac is sometimes used. It should be applied while the metal is warm.

(6) W. P. asks for a formula for making an invisible ink which will become visible on the application of some dilute acid. A. Use dilute copperas (iron proto sulphate); tannic acid or any liquid containing it (as strong tea) quickly develops a black ink when brought into contact with the writing. Dilute nitric acid or chlorine water will also render the writing visible, especially if treated afterward with a drop of ammonia or potassium ferrocyanide.

(7) C. K. asks: What will cement hard rubber? A. Fuse together equal parts of gutta percha and genuine asphaltum; apply a very little hot to the joint, closing the latter immediately with pressure.

(8) In answer to F. C., S. H. K., and others, who ask how to make an aquarium watertight.—The joints may be packed in caoutchouc, and further sealed with a cement prepared by melting together over a gentle fire 1 lb. of resin, 4 ozs. of good tar, and about 1 oz. of linseed oil. If an excess of oil is used the cement will become too fluid; to obviate this it should be tested before use by allowing a small quantity to cool under water, and if not sufficiently firm, allowed to simmer longer or have more tar and resin added. The cement should be poured in the angles of the aquarium while in a liquid state, but not when boiling, as it would crack the glass. The cement, when properly made, becomes firm in a few minutes.

(9) J. G. S. asks: What would be the approximate cost per mile of a narrow gauge railroad, complete, through a level country? A. The cost of such a railroad will, of course, depend on the character of the country and the length of the road. The following estimate was made for a road of 3 feet gauge, 100 miles long, over a prairie country: Grading, bridges, ties, tracks, stations, etc., \$9,520 per mile; rolling stock, \$3,791 per mile.

(10) W. H. H. asks: What is the process commonly practiced in bleaching white goods? A. The goods are first immersed in dilute solution of chloride of lime (bleaching powder), and then transferred to a vat containing very dilute sulphuric acid. This treatment may be repeated if necessary, and the material finally thoroughly washed.

(11) O. H. K. writes: I have a steam launch, and condense the exhaust through a copper pipe running around the stern close to the keel. Some persons tell me that the feed water will injure the boiler from the action of the copper pipe. Is this the case, and if so is there any remedy? A. Any deleterious action can be prevented in great measure by tinning the pipe.

(12) P. C. O. asks: How shall I loosen the scale in a steam boiler? A. Without knowing the character of the scale, we cannot suggest any remedy. Generally, by allowing the water to remain in the boiler until cold, the scale is softened so much that it can easily be removed. If there is a great accumulation, this blowing off must take place very frequently.

(13) W. & B. write: We have a garret room that we wish to ventilate so that we can work in it. It has a sheet iron roof, is 25 x 90 feet, and 7 feet high; has two windows in each end, but they do not give air enough. Could a fan be put in the roof; and if so, of what kind? A. If you have an opening to admit cool air, and another for the discharge of heated air, a suction blower placed by the latter opening, or a pressure blower by the former, will answer very well.

(14) S. E. T. writes: I am building a tank 7 x 8 feet, 6 feet deep, in my stable to hold water for household purposes. It is made of pine strips, 1 1/2 in. x 2 in., laid flat, with whitelead joints. Do you think it will be necessary to line it, and if so, what had I better use? A. It will not be necessary to use any lining, if properly made. If, however, you desire to do so, waterproof paper will answer very well.

Is it advisable to let the water from the leader of a bay window and piazza run into the trench filled with broken stone which forms the foundation of a drive way? A. We think not.

(15) C. D. asks: How shall I make a "bellows body" (like an accordion) for a camera, to be of 1/4 inch strips, 5/8 inches wide, and 8 inches high when finished? A. Cut the four strips to size, stitch the edges of the sides together at points 3 inches apart, push in the edges between each of these points to form the base of the hinges, and insert the gore pieces. These may be 3 inches wide and 3/4 or 5/8 inches long, slit lengthwise 1/2 to 3/4 inch on the middle line at each end, and the corners folded toward the center to form a square about 2 1/2 inches wide; then placed reverse side down and folded once to a triangle. A few blows with a mallet will then set the folds. The pieces are inserted, obtuse angle outward, in the seam edge of the hinge, and the slit edges unfolded and glued to the in-folded portions of the hinge.

(16) "Sapphire" asks what cement is used by lapidaries for cementing precious stones. A. Armenian or diamond cement. Soak isinglass in water until it is soft; then dissolve it in the smallest possible quantity of proof spirits by the aid of gentle heat (over warm water); in 2 ozs. of this dissolve 10 grains of pale gum ammoniacum (in tears) by trituration in a mortar; then add six large tears of gum mastic dissolved in not more than 6 times their weight of rectified spirits. Keep in a well stoppered bottle, and soften for use by standing the bottle in hot water.

(17) W. H. A. asks for a recipe for making a good indelible ink, in shape that can be conveniently applied by means of a rubber stamp. A. Genuine asphaltum, 1 part; benzole, 4 parts; dissolve and temper with good printer's ink.

(18) R. H. H. writes: A friend and myself had a dispute in regard to steam boilers. I claim that, with a full supply of water in the boiler, and not using any steam, you can get pressure enough to burst the boiler by keeping up a hot fire. My friend claims a boiler cannot burst with steam pressure so long as the supply of water is kept up. A. If you get pressure enough, the boiler will be ruptured all the same, whether it contains water or not.

(19) F. G. S. asks for a recipe for black varnish. A. Amber, 1 lb.; fuse; add hot drying oil, 1/2 pint; powdered black rosin and Naples asphaltum, of each 3 ozs.; when properly incorporated and considerably cooled, add oil of turpentine, 1 pint. This is one of the finest black varnishes in use.

Also a recipe for a japan. A. Shellac, 1 oz.; wood naphtha, 4 ozs.; lamp black or ivory black to color.

(20) S. P. S. asks: What is the proper course of study for one who wishes to become a steam engineer? A. He should study works on mathematics, natural philosophy, and prime movers; and should also study actual examples of steam machinery. In addition, he should practice drawing and the use of machine tools.

(21) In answer to O. T. K.—If you take the dimensions of a large engine, say 24 x 48, you can get a fair idea of what is needed for an engine built on a smaller scale, in the case you mention.

(22) C. W. K. asks: In the propulsion of a boat, is the speed attained in direct proportion to the power employed; if not, what proportion does the power bear to the speed? A. The ratio is not exactly determined, as it is not constant at all speeds. For moderate speeds, the power varies nearly as the cube of the speed.

(23) G. I. B. asks: What should be the dimensions of a floating dock large enough to lift and contain a vessel of the following dimensions: 300 feet long, 40 feet beam, and drawing 22 feet of water? A. Having fixed the shape of your dock, you may assume that each cubic foot of water displaced by it requires a load of 62.5 lbs., from which data you can obtain the requisite dimensions.

(24) W. S. W. writes: I have a clinker built boat, 30 feet long and 6 feet beam, which I wish to convert into a steam launch. Is a screw of more advantage than a paddle wheel, and if so, what size engine and what kind should I use to give a good rate of speed? A. You can use a vertical engine, 3 x 5, and a propeller with diameter equal to draught, and 3 feet pitch. We think this arrangement will be more desirable in some respects than paddle wheels. If the boat is very light, it may need to be stiffened somewhat for the machinery.

(25) In answer to T. L.—The expansion of various metals, on being heated 1°, is as follows:

Zinc.....	1-61920 Copper.....	1-104400
Lead.....	1-78840 Gold.....	1-126180
Iron.....	1-68180 Wrought iron.....	1-149000
Tin.....	1-67840 Steel.....	1-151200
Silver.....	1-85040 Cast iron.....	1-168000

(26) T. A. P. asks: 1. Can I make a small rowboat by stretching canvas upon a wooden frame? A. Yes; such boats are sometimes used for hunting. They are easily damaged. 2. How can I make the canvas waterproof? A. Paint it, after securing to the frame, with whitelead or other good paint.

(27) In answer to J. R. E.—The samples of test paper appear to be georgina (dahlia) paper, prepared by steeping strips of white, uncalendered paper in a not over strong tincture of *Georgina purpurea*. It is found in most well ordered laboratories. Though ordinarily not quite as delicate in reaction as litmus, it may often be conveniently substituted for the latter. The faint purplish color of the paper is rendered pinkish red by dilute acids and green by weak alkalis.

(28) E. O. H. asks: At what rate does sound travel? A. At 1,000 feet per second in air, under ordinary conditions.

What preparation can be applied to the inside of pottery to make it waterproof? A. Almost any of the vitreous glazes will answer. Borax, flint, glass, etc., are commonly used.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. W. C.—Slate containing pyrites.—J. A. P.—The deposit consists mainly of clay, silica, lime sulphate iron oxide, and a little organic matter. It may be used as a cheap pigment, either before or after calcination. It does not contain phosphates.—J. J.—No. 1 is red Jasper, an impure quartz, the coloring matter of which is iron sesquioxide. No. 2 is dolerite, containing iron pyrites, of no value.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Hearing by the Teeth. By W. B. W.
Antiquity of Civilization. By F. S. J.
Science of Light. By T. B. McC.
A Mechanical Question. By J. D. H.
Causes affecting the Taste of Drinking Waters. By J. L. M.

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

EXPLOSIVE DUST. A COMPREHENSIVE description of the Dangers from Dust in various Manufactures and the Cause of many Fires. How combustible substances can explode. Spontaneous Combustion of Iron, Charcoal, and Lampblack in Air. Flour Dust and Brewery Dust Explosions. Explosions of Coal Dust in Mines. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 125. Price 10 cents. To be had at this office and of all newdealers.

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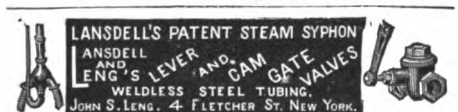
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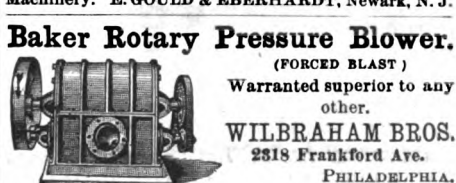
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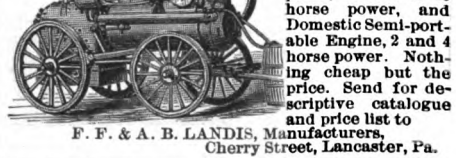
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